

California Solar Initiative

Business Model: Plug and Play Solar PV Kit

Innovative Business Model

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BIRAenergy



A. Contents

A.	Contents.....	i
B.	Table of Figures.....	iv
C.	List of Tables	vi
D.	Acknowledgements.....	vii
E.	INTRODUCTION.....	1
F.	BUSINESS MODEL FOR AC-PV SYSTEM-KIT	2
a.	Market Analysis: Current Status and Opportunities.....	2
1.	Current U.S. Solar PV Market.....	2
2.	US Residential Solar PV Market	3
3.	California Solar Industry.....	7
b.	Value Proposition.....	10
4.	Reduced Cost and Complexity of Mounting	11
5.	Increased System Performance and Safety	13
6.	Simplify and Enable Installation by Standard Roofing and Electrical Contractor Trades	15
7.	Brand Awareness	17
c.	BUSINESS MODEL and STRATEGY RECOMMENDATIONS	19
8.	Target Existing Homes Retrofit Market	19
9.	Bundle Product with Other Services	20
	Re-Roofing.....	20
	Energy Efficiency Upgrades.....	22
10.	Develop Strategic Relationships and Key Partnerships across Value Chain	22
11.	Leverage Existing GE Capabilities and Experience Across the Value Chain	23
	Financing	23
	GE Energy Efficiency Products	24
	GE’s After-Sales Customer Service and Support.....	24
12.	Marketing Channels	24
13.	Marketing Outreach Medium	25
14.	Tap into Existing Distribution Channels and Innovate	25
	Distribution and Sales: Tie up with Small and Big Box Stores.....	26

Introduce New exclusive PV Stores and Kiosks – One Stop Shop.....	26
15. Marketing Message.....	28
16. Extend Product Integration to offer DIY integrated Kits.....	29
G. II. CONSUMER VALUE MODEL.....	32
d. Value for the Intermediate Consumers – Distributors and Third Party Owners	32
17. Market Opportunity for Solar, Re-Roofing and Energy Efficiency Retrofits	32
18. Revenues and Costs	33
e. Value for the End Consumers	34
19. Financing Options Enable End Consumer Adoption	35
20. New Innovations in Financing: Third Party Ownership.....	35
H. III. FEEDBACK FROM END CONSUMER and STAKEHOLDERS.....	36
f. Market Assessment for Identifying Test Homes.....	36
g. Homeowner Market Feedback on Solar PV	36
h. Marketing Flyers and Survey Design.....	36
i. Survey Distribution	43
j. Survey Results	44
21. Classifying the Home Characteristics	60
22. Solar PV Market Penetration	61
23. Installation Triggers and Timing.....	63
24. Decision Motivations for Solar PV – Financial, Social and Quality.....	63
Financial Motivations.....	63
Social motivations	65
25. Free response Question	67
k. Survey Conclusions	68
26. Large Market Opportunity	68
27. Financial Deterrents and Importance of Financial Solutions	68
28. Importance of Retrofit Channel	68
I. CONCLUSION.....	69
l. Plug and Play Solar PV Kit has Significant Advantages.....	69
m. Large and Growing Solar PV Market Opportunity	69
n. More Innovative Business Model Strategies Required.....	69
o. Need to Focus on Residential Retrofit Market	69

BUSINESS MODEL – Plug and Play Solar PV Kit

p. Bundle PV Systems with Financing Solutions	69
q. Continue RD&D System Development.....	70
Appendix I. SDG&E Newsletter – Reroof and Solar Message	I-1
Appendix II. News Release on Demonstration Home from City of Chula Vista	II-1
Appendix III. Marketing Flyer - Open House Chula Vista Demonstration Home	III-1
J. REFERENCES	1

B. Table of Figures

Figure 1: Business Model Strategy Development Process.....	2
Figure 2: Solar PV Growth across Residential, Non-Residential and Utility Scale	3
Figure 3 The California TPO market share increased due to increased availability of residential solar loans and PACE financing	4
Figure 4: Average Installed Price by Market Segment, Q2 2011-Q2 2013	5
Figure 5: US PV installation Forecast 2010-2016	6
Figure 6: California Solar Statistics.....	7
Figure 7: Top Ten States by Q2 2013 Installations.....	8
Figure 8: CSI Residential PV Program Installation Data, by Administrator	9
Figure 9: GE Smart Grid Ready Solar Electric System	10
Figure 10: Benchmark 2010 residential PV system price: breakdown by element	11
Figure 11: Traditional Central Inverter Architecture vs. Distributed Microinverter Architecture.....	14
Figure 12: Smart Grid-Ready Residential Solar Electric System’s integration with the Microgrid	15
Figure 13: Exploded View of Insert and Capture/Plug-and-Play Mounting System	16
Figure 14: Comparison of Solar PV Installation Time between Germany and US	17
Figure 15: Solar PV Value Chain – Solar Manufacturers can vertically integrate across the value chain for effective market penetration and fully realize the value of their integrated solar PV system	19
Figure 16: Top Residential Solar PV Installers by Market Share: Roofing Company Petersen Dean is 5 th nationally	21
Figure 17: Top Residential Solar Installers, 2012	21
Figure 18: Need Key Strategic Partnerships across the Value Chain for Product Deployment	22
Figure 19: GE Marketing Channels: 1) Roofers 2) Utility or 3) Directly	25
Figure 20: Apple Store in New York	27
Figure 21: <i>Your Energy Solutions</i> has two retail showrooms in Pleasanton, CA and Rancho Cordova, CA	28
Figure 22: DIY Complete Kit example – Centrosolar Example	30
Figure 23: Two Consumer Categories	32
Figure 24: Costs Associated with Each Step of the Value Chain	34
Figure 25: Webshot from the Project Page Created on BIRAenergy (ConSol) Website	37
Figure 26: Snapshot from SDG&E Monthly Newsletter April 2011	38
Figure 27: Developed Marketing Flyer on Integrated System	39
Figure 28: Developed Flyer on Solar	40
Figure 29: Survey Design Logic I.....	41
Figure 30: Survey Design Logic II	42
Figure 31: City of Chula Vista News Release on Demonstration Showcase Home	43
Figure 32: Open House Marketing Flyer for the Showcase Home – “Plug-and-Play” Solar PV System	44
Figure 33: Survey Results, Chart 1	45
Figure 34: Survey Results, Chart 2	45
Figure 35: Survey Results, Chart 3	45
Figure 36: Survey Results, Chart 4	46

Figure 37: Survey Results, Chart 5	47
Figure 38: Survey Results, Chart 6	48
Figure 39: Survey Results, Chart 7	49
Figure 40: Survey Results, Chart 8	50
Figure 41: Survey Results, Chart 9	51
Figure 42: Survey Results, Chart 10	52
Figure 43: Survey Results, Chart 11	53
Figure 44: Survey Results, Chart 12	54
Figure 45: Survey Results, Chart 13	55
Figure 46: Survey Results, Chart 14	55
Figure 47: Survey Results, Chart 15	56
Figure 48: Survey Results, Chart 16	56
Figure 49: Survey Results, Chart 17	57
Figure 50: Survey Results, Chart 18	57
Figure 51: Survey Results, Chart 19	58
Figure 52: Survey Results, Chart 20	58
Figure 53: Survey Results, Chart 21	59
Figure 54 26: Results Graph: Year of Home Construction	60
Figure 55: Results Graph: Home Sizes.....	61
Figure 56: Results Graph: Roof Pitch	61
Figure 57: Results Graph: Current Solar System Presence	62
Figure 58: Results Graph: Solar PV Triggers	63
Figure 59: Results Graph: Classifying Financial Concerns	64
Figure 60 32: Results Graph: Impact of Financial Concerns.....	65
Figure 61: Results Graph: Comparing Various Concerns	66
Figure 62 34: Results Graph: Decision Impact for Installing Solar PV	67

C. List of Tables

Table 1: Solar PV Installation Costs Breakdown, Including Labor Requirements by Component 12

Table 2: Installation Costs for a 4.8 kW Smart Grid Ready Solar Electric System kit..... 12

Table 3: Summary of Estimated Energy Savings and Invested Capital Required in Each Segment of the
Residential Market..... 33

D. Acknowledgements

E. INTRODUCTION

As new and innovative business and financial models continue to address the long standing economic barrier to Solar Photovoltaic (PV) ownership, PV systems are being increasingly adopted by homeowners. Also as the cost of solar PV systems decreases across the PV value chain -, lower upfront costs, simpler permitting and installation, and increased reliability of systems will encourage wider adoption of solar PV.

This report discusses residential PV products and their current market, and explores business models and strategies for their large scale adoption and implementation. The report focuses specifically on the “plug and play” ready-to-install PV system-kit for retrofitting homes using the recent innovation by GE– the “GE Smart Grid Ready Solar Electric System” as an example. The research, business model and strategy developed for this GE system is applicable to similar ready-to-install PV system-kits that have been developed or will be developed by other companies.

The report is divided into three main sections outlined below.

- I. **Business Model and Strategy** –Current status of the PV market and recommended strategies for business models to take advantage of the products’ special features and for distinguishing the PV system-kit in the residential retrofit market.
- II. **Consumer Value Model** –Estimates of the opportunity for solar re-roofing and the value proposition for roofing contractors and end consumers.
- III. **Consumer Market Survey and Feedback from Key Stakeholders** – Results and conclusions from a consumer survey

F. BUSINESS MODEL FOR AC-PV SYSTEM-KIT

This section discusses the current market for residential solar PV, the drivers of retrofit PV market growth, the opportunity resulting from the potential market growth, the unique value proposition of a simple to install PV system-kit that requires only the roofer on the roof, and a business model and strategy specific to the PV system-kit design that has the potential to substantially increase retrofit PV market adoption.

The Business Model section follows the process shown below to develop effective business model strategies for the AC-PV system-kit.

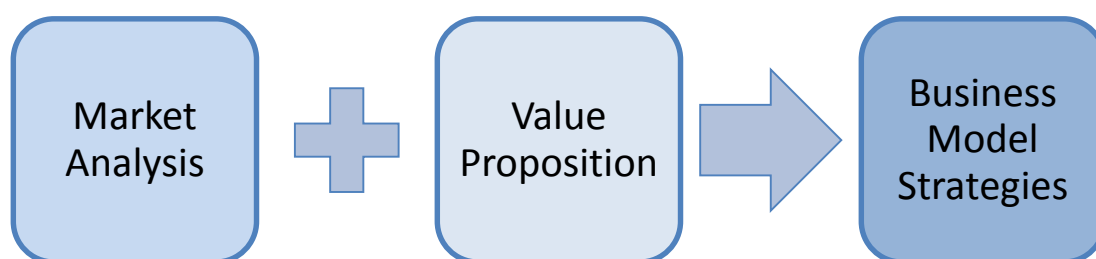


Figure 1: Business Model Strategy Development Process

a. Market Analysis: Current Status and Opportunities

1. Current U.S. Solar PV Market

The market for solar PV in the U.S. has been growing exponentially, driven by falling silicon prices, incentives, competition from module manufacturers in international markets and innovative business and financing models. For example, more solar was installed in the U.S. in the first half of 2012 than in the years 2009 and 2010 combined. Figure 2 depicts the growth of solar installations over the last 14 quarters across residential, non-residential and utility scale projects. SEIA/GTM Research indicates the overall solar electric market will be on pace for another record year, with 4,400 MW of PV and over 900 MW of concentrating solar power (CSP) projected to come online in 2013.

The declining solar PV costs across the solar PV value chain, innovative financing models such as power purchase agreements (PPA) and leases, and increasing state and federal policy support through rebates, incentives, tax and other benefits, have all contributed to an increase in solar PV's share of the overall energy mix in the U.S. These factors have built upon the motivations for solar energy – energy security, generation during peak and at the point of use, environmental benefits, and reduced dependence on fossil fuels and associated risks.

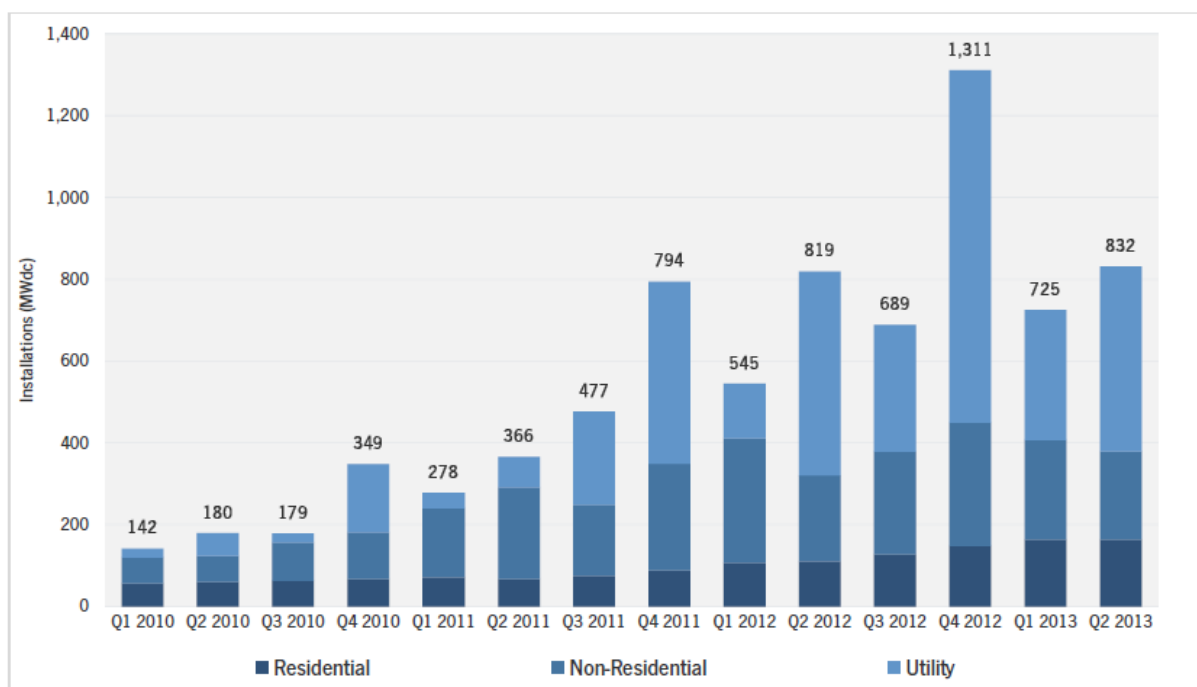


Figure 2: Solar PV Growth across Residential, Non-Residential and Utility Scale¹

2. US Residential Solar PV Market

The Solar Energy Industries Association (SEIA) U.S. Solar Market Insight Q2 2013 reports that the U.S. installed 832 MW of PV in Q2 2013 representing a 15% growth over Q1 2013 and a 1.5% increase from Q2 2012. California, Arizona, and New Jersey led residential installations nationally.

While the Q2 2013 residential market was softer than expected, remaining flat in Q2, the SEIA preliminary data suggest that Q3 will be substantially stronger. On a national level, California is up 4% over Q1 2013 in spite of the end of the California Solar Initiative incentives. The CA residential market continues to thrive and the outlook remains strong, pending changes to rate design and net metering.

In the residential segment, third-party-owned (TPO) residential PV systems continue to be an attractive option for homeowners (Figure 3). California's TPO market share increased, although well below the 2012 peak due to increased availability of both residential solar loans and PACE financing. In some states, the improved housing market led to more systems being financed through mortgages and home equity loans. A maturing TPO market can achieve reduced better equipment supply contracts and access to lower cost of capital through increased deployment rates. However, they will be affected by changing state-level incentives and the role utilities play in the distributed generation market.

, 2012 SEIA report² – .

¹Source: U.S. Solar Market Insight: Q2 2013 Executive Summary (<http://www.seia.org/research-resources/solar-market-insight-report-2013-q2>)

² <http://www.seia.org/research-resources/us-solar-market-insight>

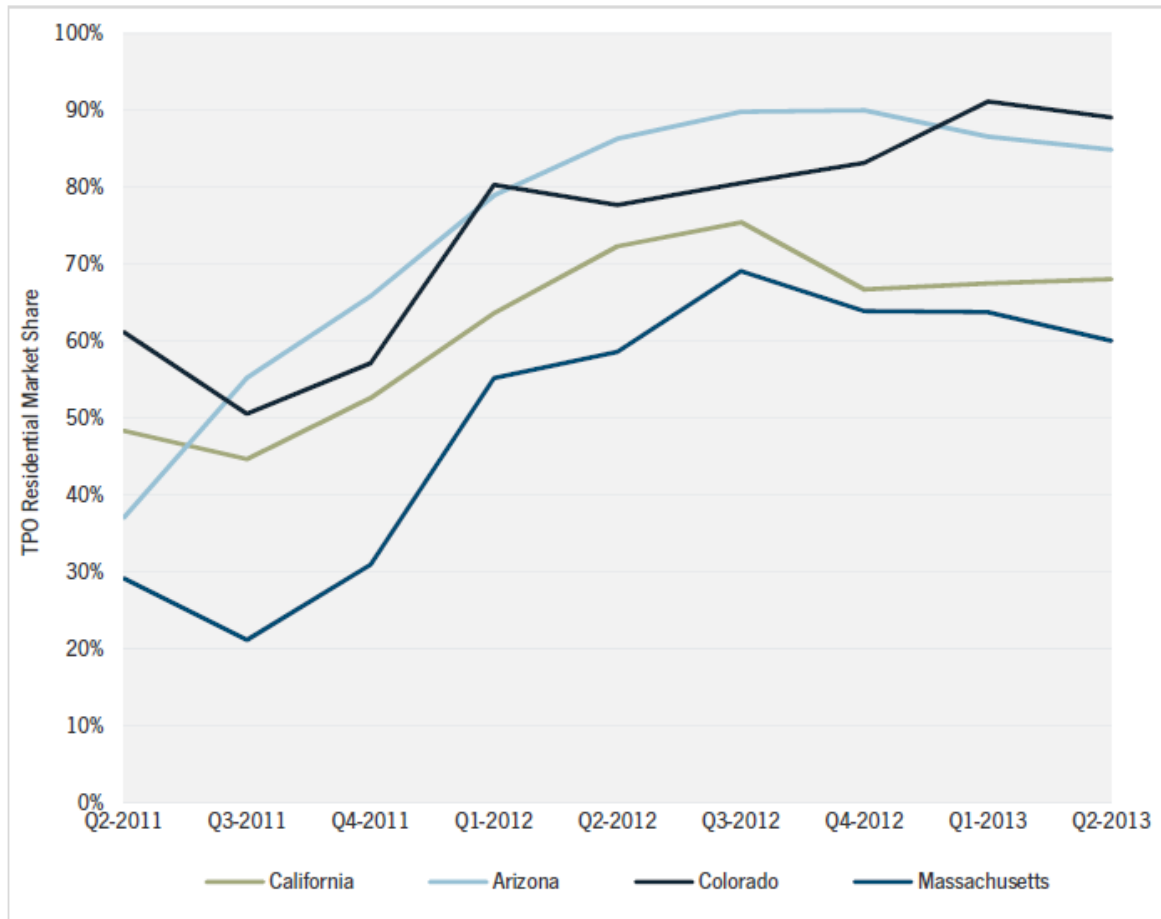


Figure 3 The California TPO market share increased due to increased availability of residential solar loans and PACE financing³

According to Greentech Media research - the success of third-party residential solar providers has attracted more than \$600 million in new investments in recent months. Greentech media further elaborates how this influx of cash into the residential space signifies the growing acceptance of solar leases and power purchase agreements as a secure investment for project investors.

³ Ibid.

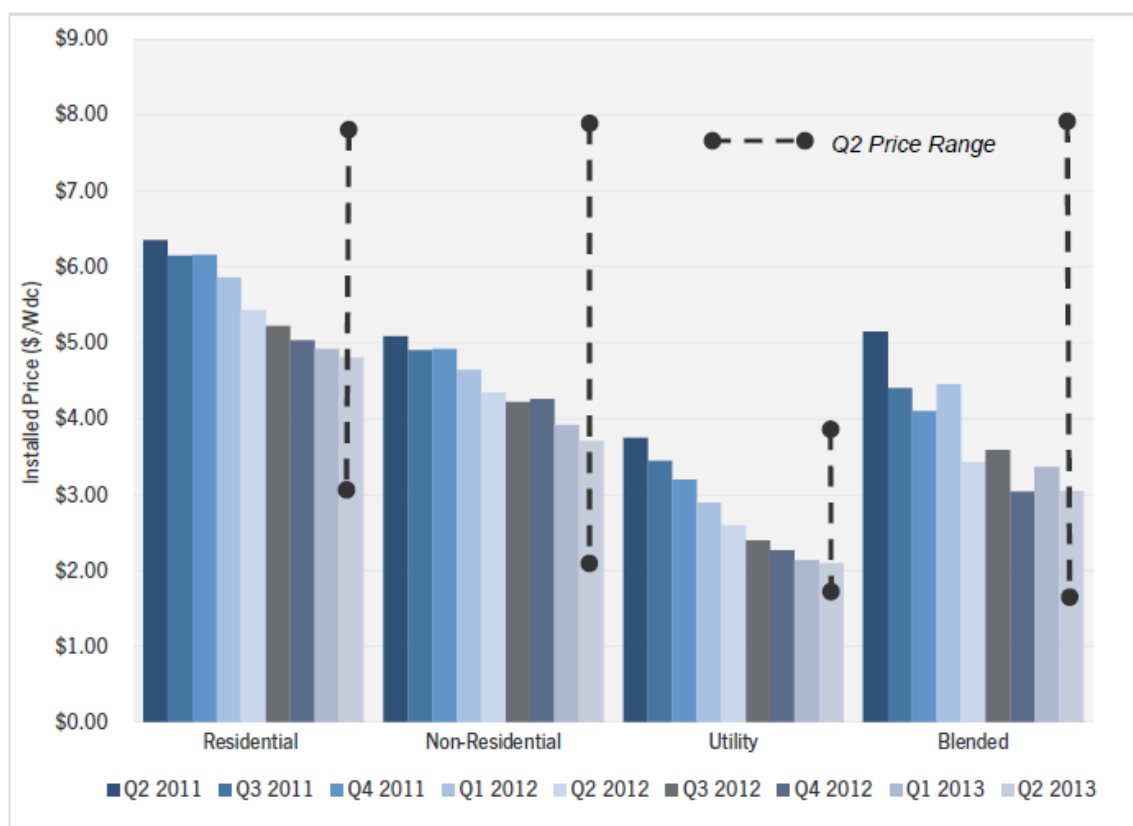


Figure 4: Average Installed Price by Market Segment, Q2 2011-Q2 2013⁴

Falling prices make solar more affordable with the average cost of a completed PV system dropping 11 percent over the past year to \$3.05/W. The average price of a solar panel has declined by 60 percent since the beginning of 2011.

The average installed price continued to decline across all U.S. market segments in Q2 2013. (Figure 4)

The national average price declined by 9.3% from \$3.36/W to \$3.05/W, while dropping 11.1% from \$3.43/W one year ago⁵. The residential, non-residential, and utility segments all saw price decreases over the past two quarters. Nationally, from Q2 2012 to Q2 2013, residential system prices fell 11.5 percent, from \$5.43/W to \$4.81/W. Over the past two quarters, installed costs declined by 2.2 percent. Installed prices came down in most major residential markets including California, Arizona, and New Jersey. Residential prices vary significantly from state to state, in part due to the maturity of the state's solar market. It was not uncommon for final installed prices to be in the \$4.00/W range not including incentives and tax credits.

⁴ Ibid.

⁵ These are capacity-weighted numbers based on all systems that were completed in Q2 across many locations and are impacted by the volume of utility-scale solar installed in a given quarter.

Installed PV prices vary greatly not only state to state, but also project to project. Without incentives or tax credits, common residential system prices ranged from less than \$3.00/W to almost \$8.00/W, and on-residential prices hit levels as low as \$2.00/W and as high as \$8.00/W. Utility prices also display high variability: a 50-MW-plus fixed-tilt installation will be significantly less expensive than a 1 MW pilot project that employs dual-axis tracking. (Note that the lowest installed cost of power does not necessarily yield the lowest levelized cost of energy, an important metric for measuring project returns, due to factors such as differing amount of sunlight striking the exact same type of solar system installed in different geographic regions.)

Figure 5 shows the forecasted installation by market segment. The SEIA residential forecast for 2013 remains steady with the second half of 2013 the highest expectations for growth in the California and Arizona residential sector. The SEIA research projects the residential market will increase the over the next few years while remaining smaller than both non-residential and utility segments.

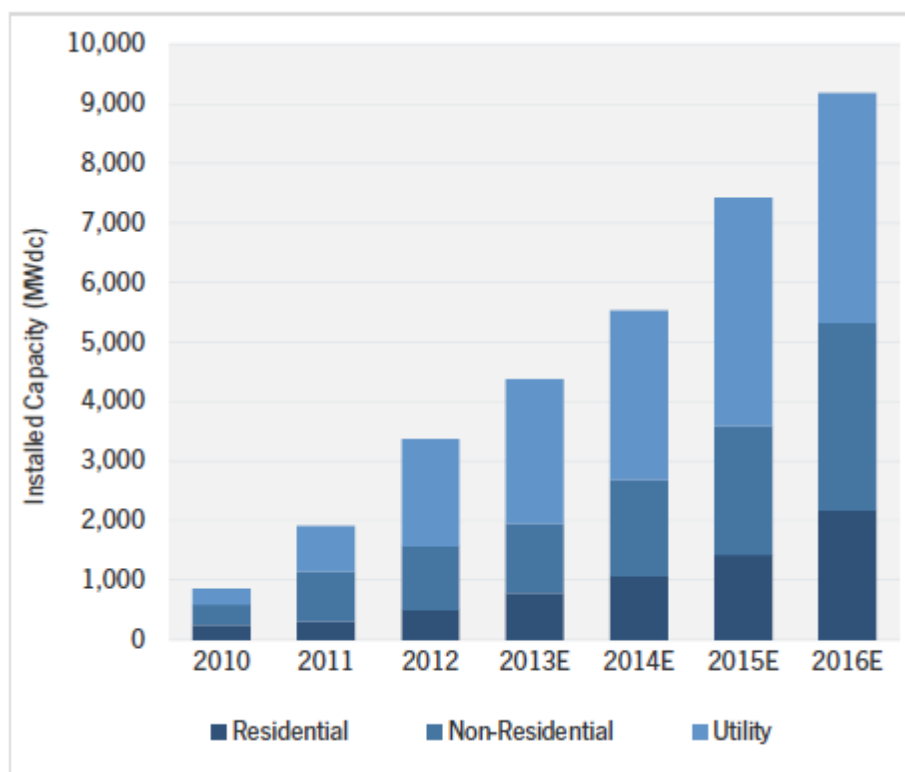


Figure 5: US PV installation Forecast 2010-2016⁶

There is still a large available residential market compared to the number of existing solar customers leaving an enormous opportunity for growth. No single strategy to deliver systems to residential rooftops has proven dominant. In the near term, it is expected that TPO PV systems will continue to

⁶ Ibid.

drive the residential market: By 2014, a myriad of new entrants are expected into the residential value chain as either financiers, service providers, or both.

3. California Solar Industry

The statistics shown in Figure 6 can be found on both the GoSolar California homepage and the California Solar Statistics front page.

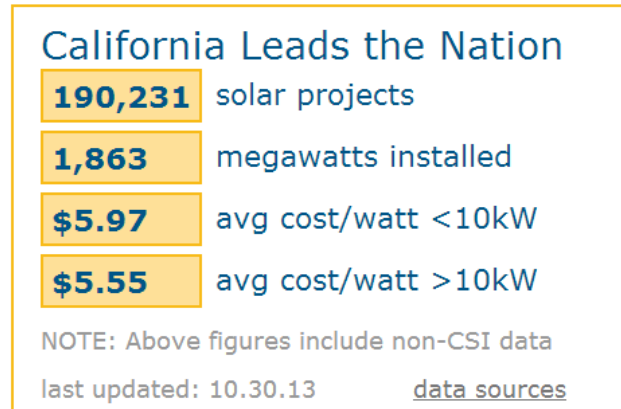


Figure 6: California Solar Statistics⁷

Q2 2013 ranks as the strongest second quarter in the California's history in spite of diminishing incentives offered by the California Solar Initiative. Installations increased by 78% in the residential market and 26% in the non-residential market over the previous twelve months. Figure 7 shows California's significant lead in solar PV installations in 2013 in both the residential and non-residential sectors. These results lend credence to the impact of California's progressive solar policies and support for the solar PV industry and its impact in both public and private sector.

⁷ <http://www.californiasolarstatistics.ca.gov/>

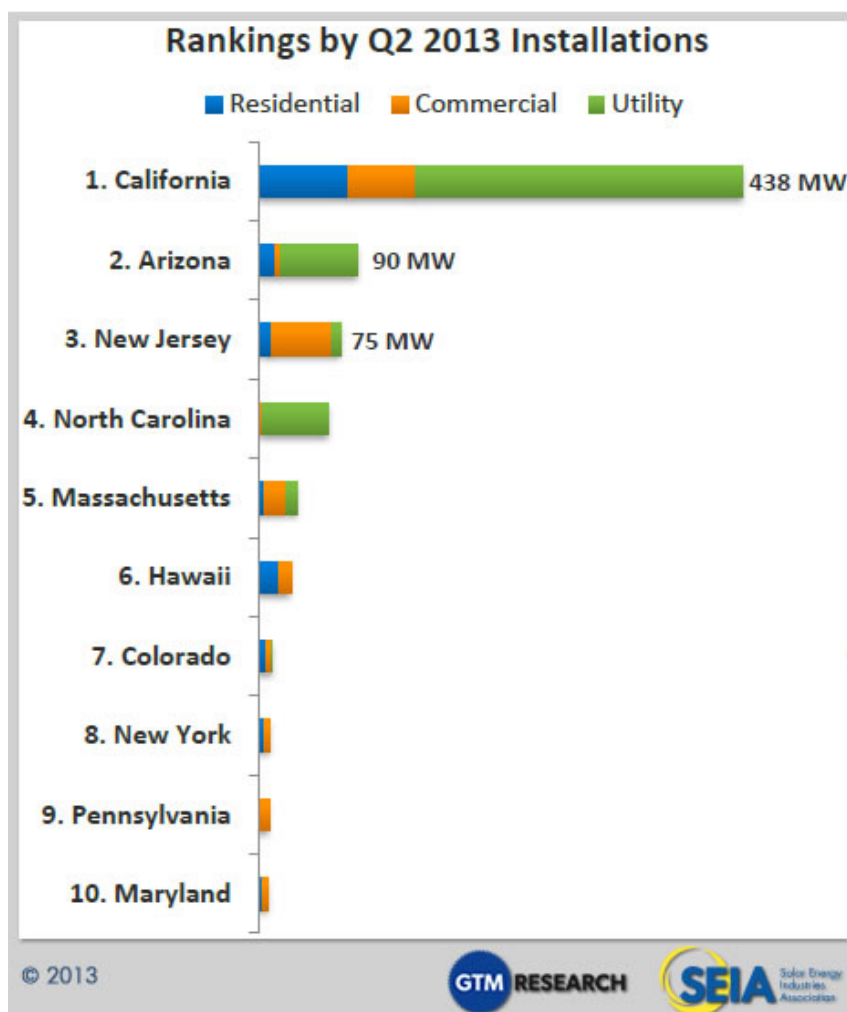


Figure 7: Top Ten States by Q2 2013 Installations

However, as California’s state-level incentives diminish, the market focus has shifted to the impacts on rate design and net energy metering (NEM) reforms in the state assembly bill AB 327. The bill carries national implications because of California’s stature as the largest and most mature solar market and its status as a policy proving ground for others to follow or learn from, How California formulates policies that maintain growth, while protecting the interests of utilities and customers without solar panels should be closely watched.

In the first two quarters of 2013, 847 MWdc of solar PV was installed in California, compared to 129 MWdc installed in Arizona and 144 MWdc installed in New Jersey. Figure 8 summarizes solar project data for each Program Administrator (PG&E, SCE, CCSE and GRID Alternatives) by number of applications and capacity (MW) under the California Solar Initiative (CSI) program. There is currently 499.3MW of residential PV installed within PG&E and SCE’s territory alone.

BUSINESS MODEL – Plug and Play Solar PV Kit

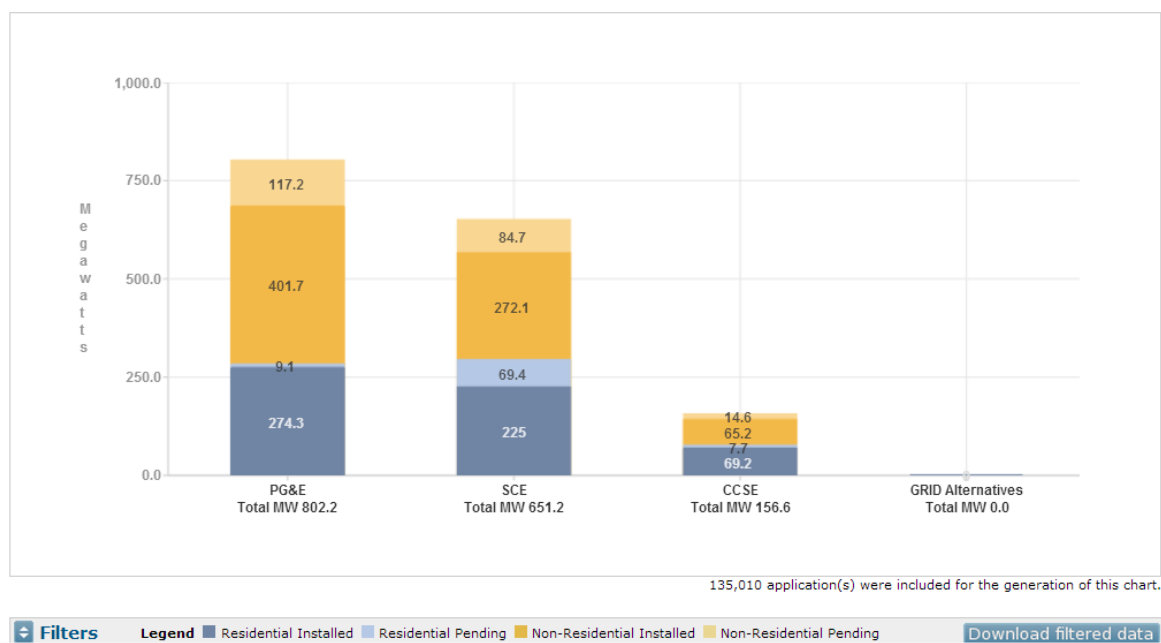


Figure 8: CSI Residential PV Program Installation Data, by Administrator⁸

⁸ http://www.californiasolarstatistics.ca.gov/reports/agency_stats/

b. Value Proposition

Improvements in both technology and manufacturing have resulted in reductions in the costs of PV system components over the past several years. However, there has been relatively little progress made in reducing the cost of installation. The “GE Smart Grid Ready Solar Electric System” is a new solar electric system design and accompanying set of installation processes that removes the need for electricians to work on residential roofs. Current DC-PV systems require electricians to make the electrical connections of panels and the through-the-roof electrical connection, whereas the AC-PV approach incorporated in the GE-type system allows the entire rooftop installation to be performed by roofing contractors with minimal training, including all electrical connections on the roof. The electrician makes the connection from a junction box below the roof to the electrical panel. This results in lower installed cost. This prototype, grid-ready, integrated product kit is designed to increase the value proposition through reduced installed system cost and improved maintenance, safety and reliability.

The “GE Smart Grid Ready Solar Electric System” is an integrated kit consisting of AC modules with direct 240 Vac output, plug and play electrical connection with tool-less insert and capture mounting system, and Home Energy Manager with Smart-Grid interface.

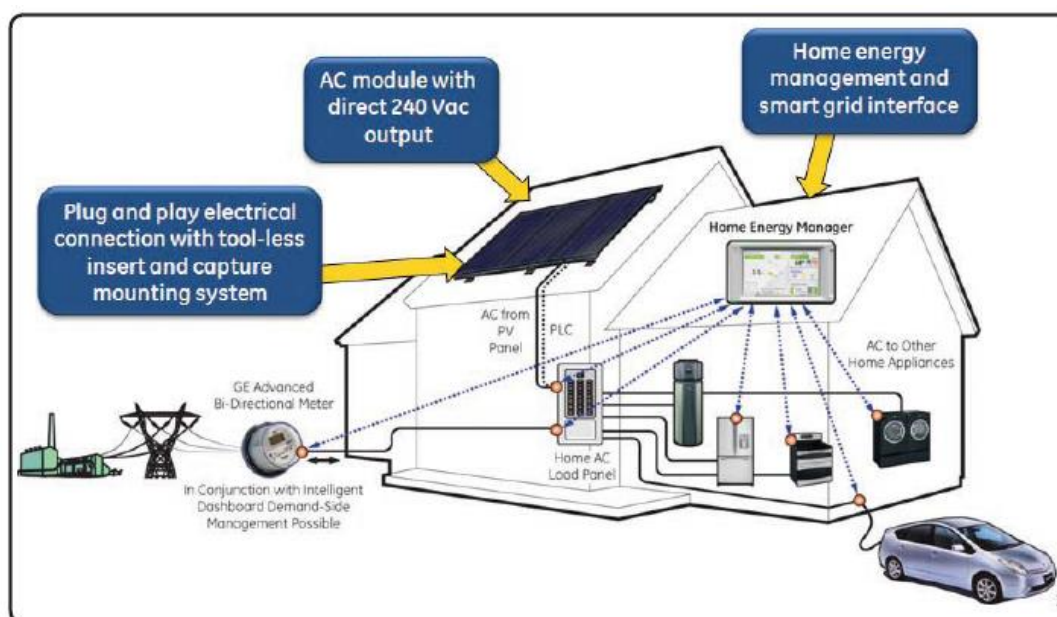


Figure 9: GE Smart Grid Ready Solar Electric System⁹

The multiple advantages of the Smart Grid-Ready Residential Solar Electric System differentiate this product from customary PV systems in the market. The system’s design innovations reduce the cost and complexity of the mounting system hardware, increase system performance and safety, and simplify

⁹ Smart Grid Ready Residential Solar Electric System, Final Technical Report Prepared for the New York State Energy and Development Authority; GE Global Research

and enable installation by standard roofing and electrical contractor trades. The value proposition for this system is described in the following subsections.

4. Reduced Cost and Complexity of Mounting

The Smart Grid-Ready Residential Solar Electric System addresses both the installation-related barriers to low-cost and high-solar electric penetration. Key advantages offered by this system include the removal of any requirement for an electrical contractor on the roof, reducing labor costs for installation, and reducing or eliminating roof-warranty confusion, because, with the roofer being the only subcontractor on the roof, he is the single contractor responsible for any leaks. This roofer-centric product installation also opens the PV market to the roofer trade, removing the need for specialty contractors (solar installers), resulting in a very large expansion of companies who might offer PV installations. The shift to roofers being the primary labor category required for the installation of the PV system, produces the corresponding potential of greatly reduce labor costs as well as access to the roofing-contractor networks of a seven million home retrofit roofing market.

The following graph from a study completed by NREL in 2012¹⁰ shows how the Balance of System (BOS) costs including the installation and labor costs comprises a major percentage of the overall installed PV system costs.

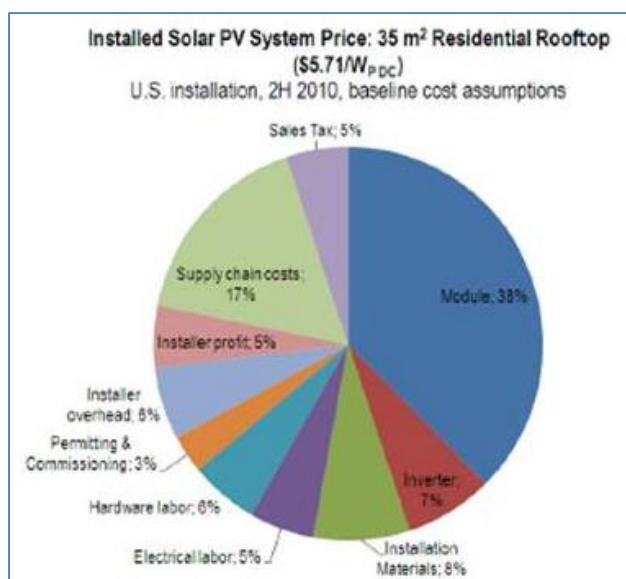


Figure 10: Benchmark 2010 residential PV system price: breakdown by element

The following table, from the same NREL study, shows the installation labor and balance of system costs for the 2010 benchmark residential PV system are a significant portion of the overall installation costs.

¹⁰ "Residential, Commercial, Utility Scale PV system Prices in the United States: Current Drivers and Cost Reduction Opportunities" NREL Study 2012

Material Category	Component costs ⁸ (per W _{PDC})	Installation labor allocation requirements			
		Units/system	Units	Electrical (hr/unit)	General (hr/unit)
Module	\$2.15 ⁹	27	Modules	0.20	
Inverter	\$0.42	1	Inverters	4.0	2.0
Wiring	\$0.03	237 ¹⁰	Linear ft	0.05	
Other electrical ¹¹	\$0.19	1	Electrical subsystem	4.5	
Mounting hardware	\$0.37	27	Modules		1.40
	\$3.16				
Total Installation Labor Requirements (hr/system):				25.7	39.9

Table 1: Solar PV Installation Costs Breakdown, Including Labor Requirements by Component¹¹

Approximately 50% of a traditional system price can be attributed a combination of the channel costs, soft costs, and installation costs. The Smart Grid Ready Solar Electric System kit provides all of the hardware components necessary for a roofing contractor to complete installation of the solar system, reducing the labor and component costs. The table below shows the estimated cost of installing a baseline 4.8 kW system having 20 ac modules and two dedicated 240V electrical circuit is \$2054 (NY labor costs). The GE Smart Grid Ready Solar Electric System significantly reduces installation costs and uses standard contracting trades instead of specially trained and certified installers.

Category	Roofing Contractor Costs		Electrical Contractor Costs		Totals	
	\$	\$/W	\$	\$/W	\$	\$/W
Materials	50		250			
Effort	800		480			
Margin	255		219			
Total	1105	0.23	949	0.20	2054	0.43

Table 2: Installation Costs for a 4.8 kW Smart Grid Ready Solar Electric System kit¹²

¹¹ Ibid

¹² Smart Grid Ready Residential Solar Electric System, Final Technical Report Prepared for the New York State Energy and Development Authority; GE Global Research

The GE Smart Grid Ready Solar Electric System significantly reduces installation costs and uses standard contracting trades instead of specially trained and certified installers—no electrician is required on the roof. The modular system comes in standardized installation kits and is suitable for both new and old roofs. The installation minimizes roof deck penetrations and does not void the roofing warranty.

5. Increased System Performance and Safety

The Smart Grid-Ready Residential Solar Electric System addresses both performance and safety through the use of micro-inverter technology, creating an AC PV system rather than a high voltage DC system. Micro-inverters produce grid-matching power – in AC directly at the back of the panel eliminating the need for high voltage DC wiring connections at each panel to a main inverter. This, in turn, eliminates the need for a trained electrician on the roof to install the panels.

Traditional PV installation uses a central (or string) inverter architecture with complex electrical installation that requires the handling of high dc voltages (600Vdc) well-above UL safety limits, heavy (> 70lbs) central dc-ac inverters, and installation of inter-module dc grounding connections. Such practices are outside the skills of the normal roofing and electrical contractor trades leading to the creation of solar installation “specialists”. With this installation practice, each residential solar installation is a custom rather than standardized design, resulting in higher installed system cost. Figure 11 shows a comparison of the central inverter vs. microinverter architecture.

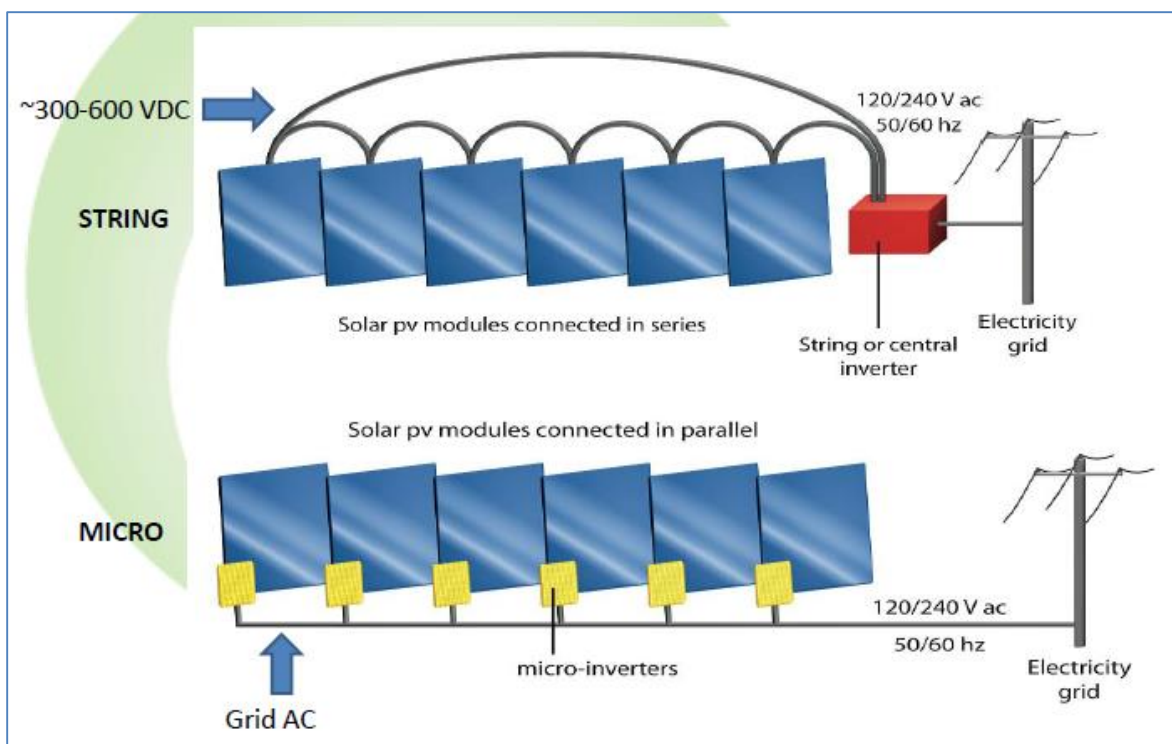


Figure 11: Traditional Central Inverter Architecture vs. Distributed Microinverter Architecture¹³

The panels are connected in parallel (rows or columns) to each other and then to the grid feed. (Figure 12 shows a first generation Smart-Grid Ready solar panel ready to be connected.) This is a major advantage in that a single failing panel or inverter does not take the entire string offline. There are also lower power and heat loads and a claimed 300 year mean-time-between-failures (MTBF)¹⁴, resulting in a higher overall reliability with a micro-inverter-based system than a traditional string inverter-based system. This should result in much longer warranties.

¹³ Source: The Solar Microinverter, Jeremiah Heilman, Ph.D, IEEE Energy Tech 2012, May 30, 2012

¹⁴ MBTF should not be interpreted as “lifetime”. Higher MBTF has been claimed by microinverter industry, but is not universally accepted.

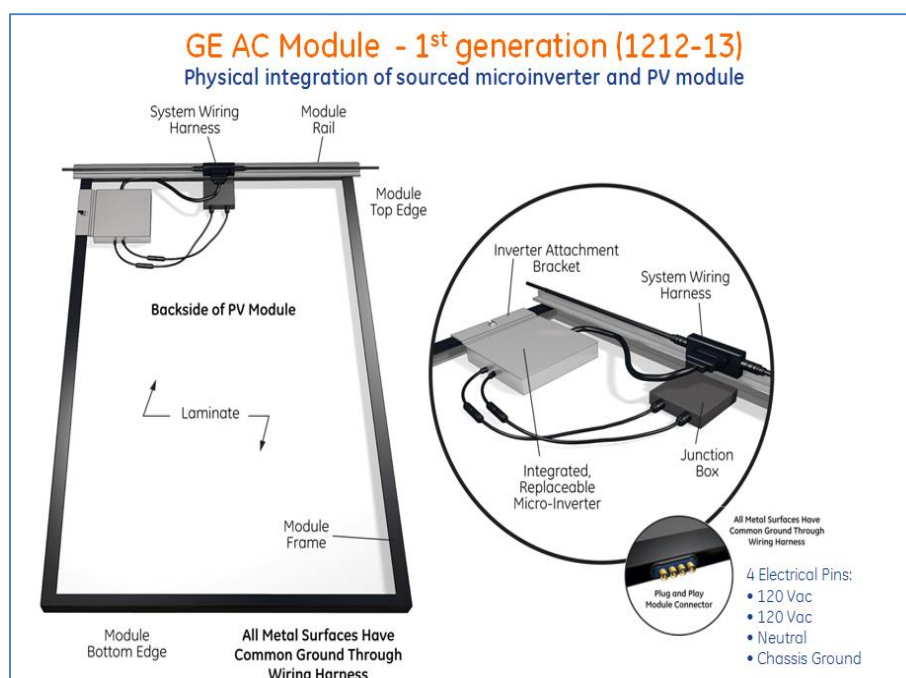


Figure 12: Smart Grid-Ready Residential Solar Electric System’s integration with the Microgrid

Traditional PV system installation requires all wiring to be enclosed in metal conduit with a separate ground circuit to ensure that exposed metal components (e.g., frames and mounting rails) remain grounded. Even with safe installation practices, there is still the potential for a system fault which can generate a high voltage dc arc.

Several building fires have been attributed to a high-voltage arc caused by a PV system failure. Consequently, the National Firefighter Protection Association (NFPA), with their own requirements regarding roof access, has a key role in determining future NEC code changes for PV systems. This has the potential to reduce soft cost in states like California where many regulations are influenced by firefighter organizations.

The Smart Grid Ready Solar Electric System has no high voltage making it inherently safer and less risky to both installers and firefighters.

6. Simplify and Enable Installation by Standard Roofing and Electrical Contractor Trades

The Smart Grid-Ready Residential Solar Electric System’s “insert and capture” mounting system design simplifies the physical installation process and provides a “plug-and-play” electrical interface that eliminates the handling of high voltage and provides an integral electrical power and ground interconnection. The insert and capture design has 40% fewer components than a traditional mounting system and allows a roofing contractor to use familiar roofing installation processes and tools while the

plug-and-play electrical connection can be completed by standard electrical contractors. There is no danger from high voltage and no individual module grounding wires are needed. The figure below shows an exploded view of this simplified mounting system.

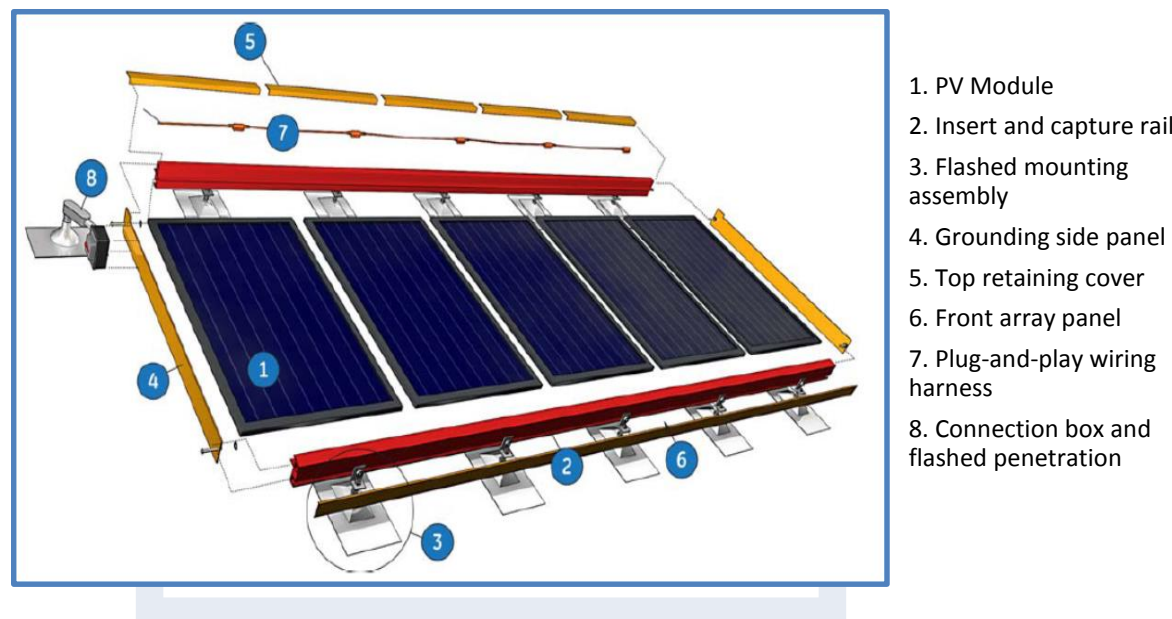


Figure 13: Exploded View of Insert and Capture/Plug-and-Play Mounting System

In addition to the reducing the safety concerns of working with high voltage, the micro-inverters facilitate a modular design that allows for easy tracking and monitoring of the individual panels within the PV system. The micro-inverter allows the monitoring of the solar power generated by each and every panel making it easy to detect and track individual PV module related issues and faults. This modular design makes the system repairable at module level eliminating the need to disassemble the entire PV system, ensuring higher efficiency, reliability and productivity.

A recent study shows that PV installation process takes a longer in the US compared to other countries¹⁵. This can be detrimental to the pace of adoption of the PV system by the US households. PV installation in Germany, which accounts for the largest installation of residential solar panels in the world, is almost 10 times faster (7.5 hours vs. 75 hours) as compared to the US. The graph below, from a recent LBNL Study¹⁶ shows that this difference increases the installed cost of a PV system by \$0.55/W in the US. Note that the data comparison between installations in Germany and the US do not take into account that the average sizes of both homes and the PV systems installed on them are smaller in Germany than in the US.

¹⁵ “Why Are Residential PV Prices in Germany so much Lower than in the US?”, LBNL Study, September 2012

¹⁶ IBID

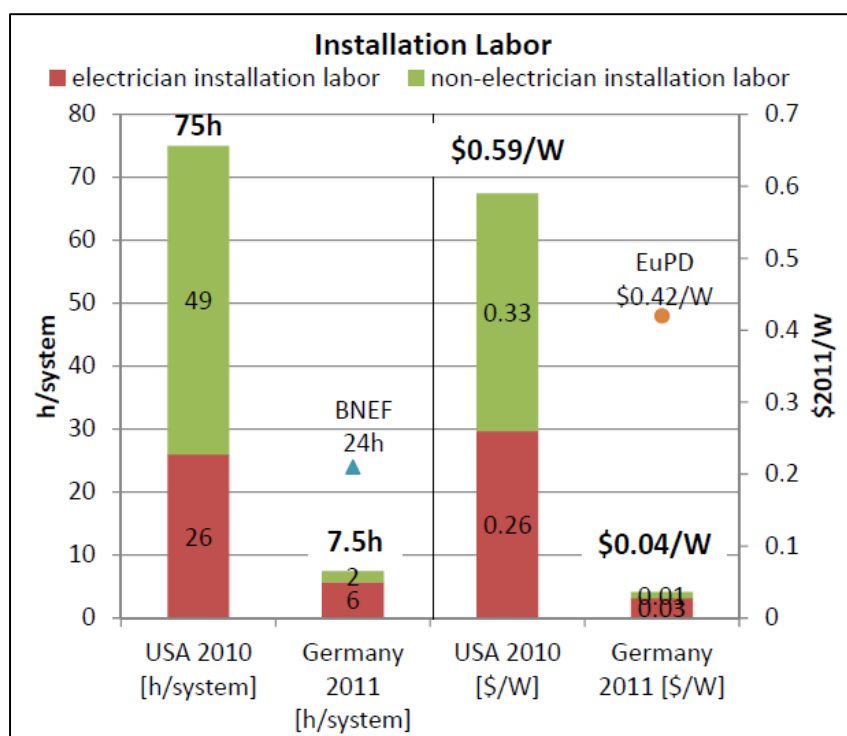


Figure 14: Comparison of Solar PV Installation Time between Germany and US

There are a number of reasons for this difference including a more evolved German PV industry, streamlined processes driven by the economies of scale, different safety and permitting standards, as well as the ease of permitting and other BOS efficiency factors. However, the cost and ease of installation are important contributors to difference in numbers of installations. The Smart Grid-Ready Residential Solar Electric System's ease of installation, a 5 kW system can be installed and all wiring and connections completed in an 8-hour day.

7. Brand Awareness

Brand awareness plays a major role in a consumer's buying decision process. GE, formed in 1892, has been in existence for over 100 years and the GE brand conjures concepts such as trust and reliability for many people.

A high level of brand awareness suggests that the brand is easily recognizable and accepted by the market in a way that the brand is differentiated from similar products and other competitors. The survey conducted during the prototype period did not specifically ask about GE brand awareness. However, survey participants ranked the impact of the solar electric product manufacturer and its impact on their decision to purchase a solar system (See Question 9, Figure 40) as moderately important. The level of brand awareness can be further explored through additional survey or study groups to determine the specific impact of the GE brand in the future. The Smart Grid-Ready Residential

Solar Electric System and its association with the GE brand has the potential for increased value through brand awareness properly marketed to the customer

This is an important USP (Unique Selling Proposition) for the Smart Grid-Ready Residential Solar Electric System. GE will enjoy an advantage over competitors if they can successfully market positive brand associations with the product. A positive brand awareness and 20+ year warranty are a distinct advantage given other PV products being provided by solar companies that may have been in existence for less than five years. Many products come from Chinese companies (accounting for 50% of the global market) who do not always enjoy a positive reputation for product quality.

This could be an important marketing message for an end-customer who may be buying the product based on an estimated 20 years of product life and a promised efficiency level or for a Business to Business (B2B) who is marketing to solar installation companies owning or leasing the system. Solar City and SunRun, example B2B companies, must in turn market to their investors and underwriters who could be more secure with the performance (certain minimum efficiency percentage) and the guarantee backed by GE than a recent solar start-up company.

c. BUSINESS MODEL and STRATEGY RECOMMENDATIONS

The business model provides detailed market information and strategy for the residential PV retrofit market. This section includes:

- 1) How the product, market, and financial considerations fit into the value chain of bringing the product to the customers in an efficient and profitable manner;
- 2) How key resources, key partners, and key activities fit into business model for ready to install (plug and play) integrated solar PV systems, across the Solar PV Value Chain (Figure 15); and
- 3) How the system can vertically integrate across the value chain to maximize the market penetration and fully realize the value of the system.

The strategy for this business model focuses on a few innovative concepts behind the Smart Grid Ready Solar Electric System. This is the first of such PV system kits, the key features of which are:

- 1) A complete PV-kit, containing all the components, which are ready and simple to install;
- 2) The AC system design, which requires only a roofer for the rooftop installation – not roofer and electrician, like most/all other systems;
- 3) A simple electrical connection - the AC output simply plugs into electrical panel; and
- 4) Lower costs due to fewer parts and the fast and simple installation.



Figure 15: Solar PV Value Chain – Solar Manufacturers can vertically integrate across the value chain for effective market penetration and fully realize the value of their integrated solar PV system

The following subsections discuss the business model and strategy recommendations for scaling up the adoption of an integrated solar PV system such as the GE system.

8. Target Existing Homes Retrofit Market

The integrated product offers a reduced installation time, it is easier and more convenient to install. The advantages discussed in the previous section make the integrated PV products ideal for retrofitting existing, occupied homes. Retrofitting should be considered an introductory market. However, the product's advantages will benefit the new construction market as well.

9. Bundle Product with Other Services

The integrated product can be bundled with other services and products. Some of the recommended options include:

- i. Re-roofing
- ii. Energy Efficiency Upgrades

i. Re-Roofing

The primary target market for the Product is homeowners of single-family homes that are undergoing a re-roofing. A secondary segment is the same type of homeowners during roof maintenance that may not be an entire roof replacement. The re-roof is a perfect opportunity for an upsell to the Product because the labor cost involved in installing the system is greatly reduced at this time. Roofers that are already onsite can be easily trained to install the product as well.

Key resources for making this value proposition accessible to the customer are the roofers themselves, having brought together financing options for the customer to consider to cement the value proposition. To the customer, the roofer is a trusted name, providing a new service in addition to the one they are purchasing already.

PetersenDean Roofing and Solar, with 30 years of roofing experience, is an example of a roofing company who now includes solar as a company offering. They have recently launched the Solar4America¹⁷ campaign to provide homeowners an affordable path to solar ownership, specifically offering “American products installed by American workers”. The figure below shows their national ranking as a solar installer.

¹⁷ <http://www.petersendean.com/solar4america/>

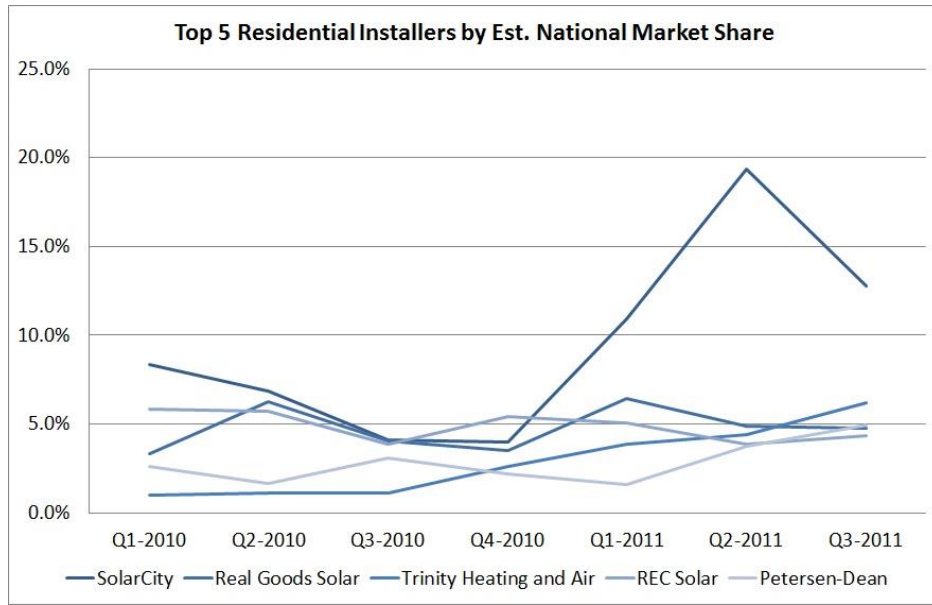


Figure 16: Top Residential Solar PV Installers by Market Share: Roofing Company Petersen Dean is 5th nationally

SolarCity dominates the market segment as a residential installer with 19.5% of the market share. However, [Figure 17](#) shows there is still opportunity for residential installers to capitalize on growing state markets and untapped consumer bases.

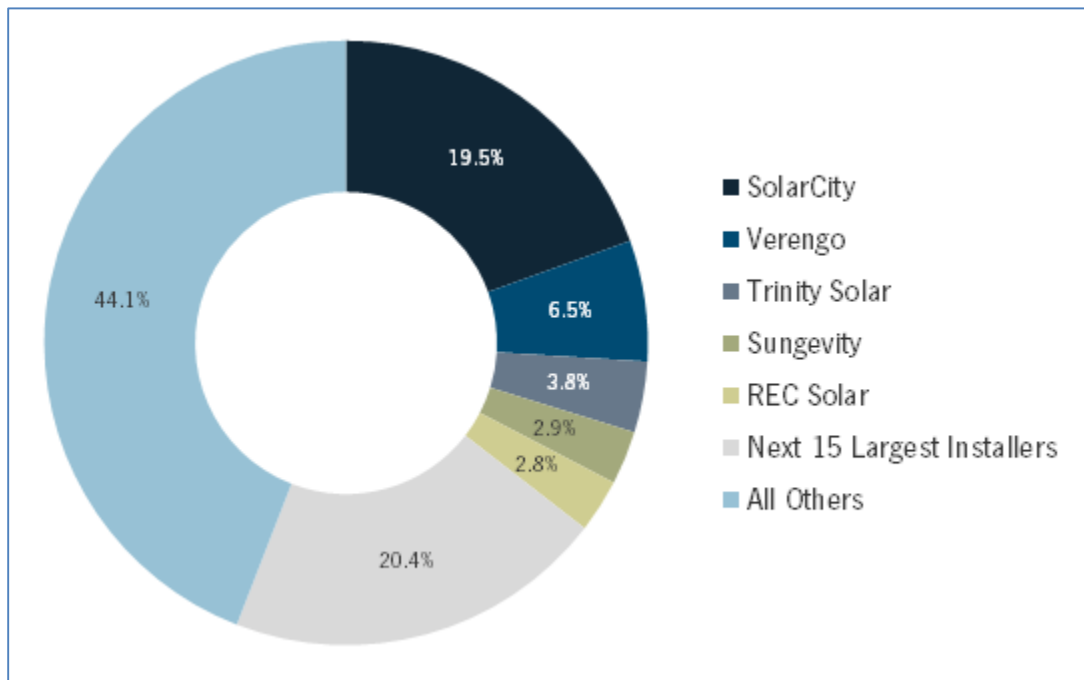


Figure 17: Top Residential Solar Installers, 2012¹⁸

¹⁸ GTM Research U.S. PV Leaderboard

ii. Energy Efficiency Upgrades

Customers getting energy efficiency retrofits are already aware and sold on the idea of reducing their energy bills and switching to cleaner energy options. It is easier to concurrently market a solar PV system to these customers and install PVs coincident with efficiency upgrades.

10. Develop Strategic Relationships and Key Partnerships across Value Chain

The solar PV market is growing exponentially and a number of big corporations and conglomerates, such as GE, are entering the PV market and will continue to vertically integrate across the value chain. The strategies and recommendations in the previous sections illustrate the importance of forming strategic partnerships in the value chain – downstream to stay competitive – for smaller PV system providers. Strategic partnerships can facilitate reduced system price and provide a better economic basis for the system. Reduce overhead and extraneous costs associated with intermediate distribution channels and find the most direct path to the end customer (e.g. homeowner) through existing relationships such as banks and utilities.

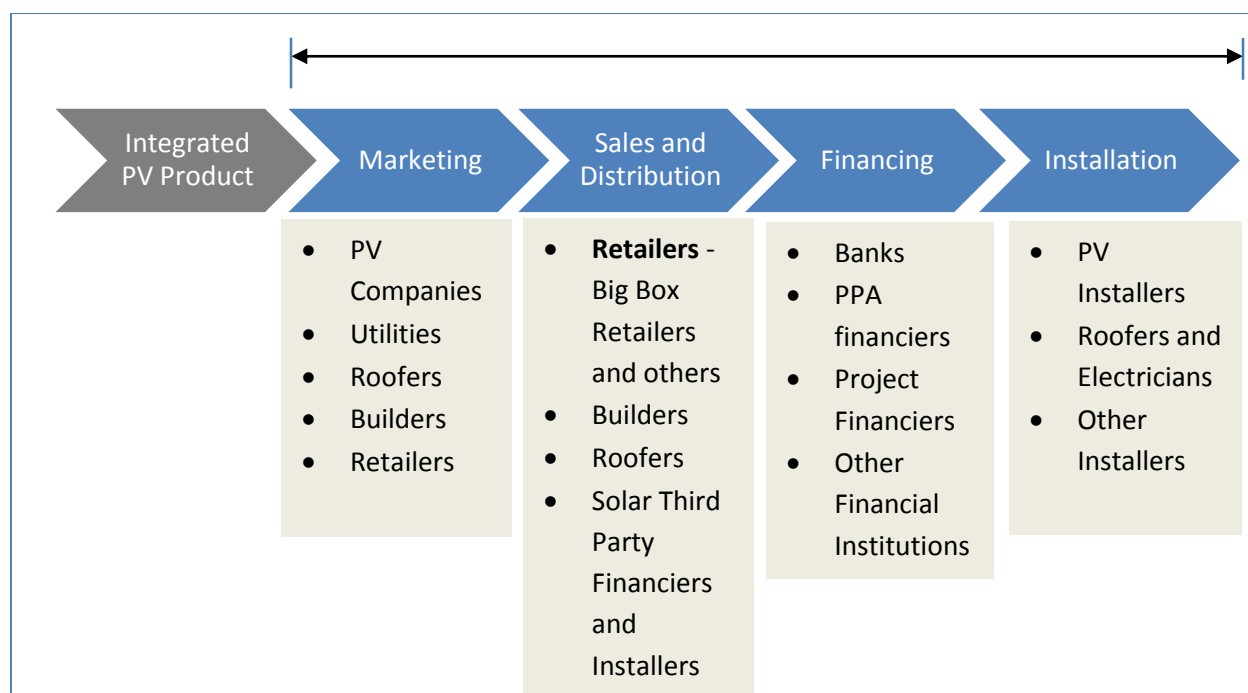


Figure 18: Need Key Strategic Partnerships across the Value Chain for Product Deployment

The integrated PV manufacturers should develop key strategic partnerships for marketing, distribution, financing and installation. The integrated PV manufacturers also need to form partnerships with key stakeholders within the value chain such as the utilities, roofers and the builders.

Depending on where the company is located in the value chain or depending on their level of vertical integration across the value chain, the company should develop strategic tie-ups across the rest of the value chain with the specified partners to compete and to enable the eventual deployment of their product.

11. Leverage Existing GE Capabilities and Experience Across the Value Chain

With the advent of companies offering innovative financing options and offering a zero upfront cost to customers, and a number of companies offering various solar PV options, the solar PV competitive landscape is getting crowded. PV companies will have to continue improving their products, services and extending their offerings to stay competitive.

As the Solar PV demand continues to grow, a number of multinationals and conglomerates will enter the market, joining the likes of GE. While the conglomerates such as GE should leverage their capabilities and experience, other companies should be aware of these competitive threats and start positioning themselves to differentiate and successfully compete with those bigger and larger corporations.

GE has the advantage of having successfully built businesses and business processes that can be leveraged when introducing, extending the product offering and marketing the GE Smart Grid-Ready Residential Solar Electric System. These are described in the following subsections.

iii. Financing

Financing is an important consideration in any solar installation. The high upfront cost associated with a solar PV system remains the biggest barrier and deterrent to solar PV adoption for a homeowner.

Recently, innovative financing models such as the Power Purchase Agreements and leases have accelerated the adoption of solar PV system in the residential market. A number of companies in the solar market such as Solar City and SunRun are providing these financing solutions, and have been responsible for the downstream value chain, while remaining agnostic to PV manufacturer or their product. As a PV manufacturer, to stay competitive it is important to vertically integrate down the value chain or form strategic partnerships with a financial institution and offer financing solutions as well.

GE can leverage its experience and capabilities in the consumer finance sector through GE Finance to offer its own financing solutions for the integrated PV system.

Financial resources tailored for the individual market will help the customer to see how the total system value will serve them with a reasonable payback and the added security of reduced exposure to energy cost fluctuations in the future.

iv. GE Energy Efficiency Products

GE has a number of products in the energy efficiency and smart grid space such as smart meters and batteries, energy efficiency lighting products, and appliances. that it could market to the customers of the Smart Grid-Ready Residential Solar Electric System . GE can cross sell and upsell various other products from its related business lines and products instead of investing in customer acquisition for each product separately. Thus while the upsell of a roof retrofit to a PV system has been discussed already – this can be taken further to cross-sell and upsell various degrees of energy efficiency and home energy management solutions to an already “converted” or “aware” customer interested in saving money and reducing their energy profile.

v. GE’s After-Sales Customer Service and Support

GE has a world-class sales and customer service capabilities and platform deployed across its various business units. The Smart Grid-Ready Residential Solar Electric System could leverage that experience to build its own customer service to further differentiate its product from that of other competitors.

12. Marketing Channels

Sales, Marketing and Distribution Channels become paramount for a new integrated PV system and a relatively new PV systems segment as a whole. There are relationships to be established at several levels to sell, market and distribute the product to each of the customer segments. Key partners such as roofers, electricians and utilities can provide resources and activities for marketing and distributing the product.

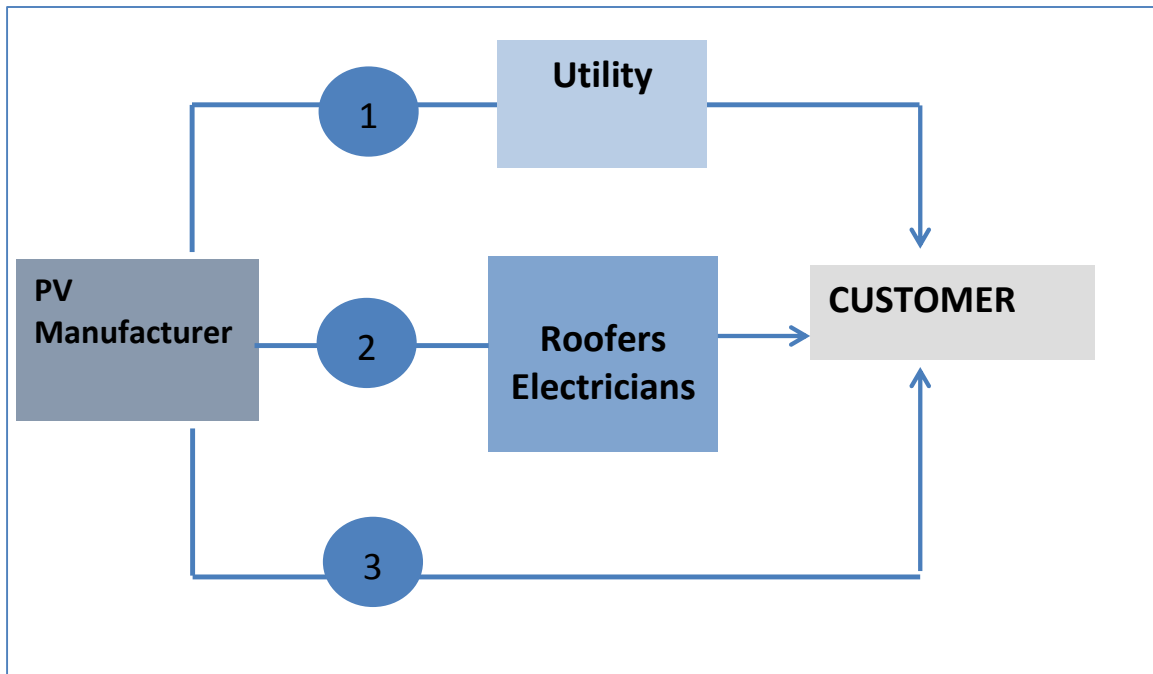


Figure 19: GE Marketing Channels: 1) Roofers 2) Utility or 3) Directly

The relationship of roofer to customer requires that GE partner with reroof and repair services with a track record of quality customer service, including responding to technical, pricing, and maintenance issues and who will refer customers to electricians or to GE when appropriate.

A third level of relationship exists between the utility and the customer. The utility provides stable energy support/Grid maintenance, customer service, and may be another point of contact to the customer that could be required to refer customer issues to GE.

13. Marketing Outreach Medium

Currently, solicitations are being done through surveys, local municipalities and word of mouth. Additional outreach channels that should be considered include television advertising, newspapers, community events, flyers at community centers, yard signs on post-install homes, utility and GE website contractor listing, setting up call centers, training and employing salesman/advisors to make home visits, marketing through roofers sought by the customer themselves who offer solar as an add-on service, bill inserts through utilities, and previous customers contacted via standard quality assurance.

14. Tap into Existing Distribution Channels and Innovate

The solar PV system manufacturers need to explore various avenues for sales and distribution to increase consumer awareness and accessibility to their products and to reach a wider consumer base. This is an essential step in a relatively new industry in the early stages of product life cycle and adoption.

vi. Distribution and Sales: Tie up with Small and Big Box Stores

There can be strategic partnerships and tie-ups with small and big box stores catering to the residential consumers – homeowners, builders and contractors. Big retailers focused on the residential construction market, such as *Home Depot* and *Lowes*, have already been approached by solar PV manufacturers and distributors.

These partnerships can be extended beyond the home construction retailers to include retailers that sell high value residential consumer products and goods, such as Home Appliances Retailers – *Sears* and *BestBuy*.

vii. Introduce New exclusive PV Stores and Kiosks – One Stop Shop

An exclusive solar PV store can go a long way to build awareness for solar and the Product. A “one-stop-shop” for all of the customer’s, providing an end-to end solutions for installing solar on the homeowner’s roof, can help to build the company’s brand. PV stores or small kiosks in malls/shopping areas/within department stores – such as *Sears* and *Home Depot* – can educate the potential customer base on the advantages of the PV segment as a whole and specifically this product and its differentiating features.

A prime example and a hugely successful parallel case study is that of the *Apple* stores that helped increase awareness and market and sell new innovative *Apple* products such as the iPod and iPad. *Apple* stores have played an important role in increasing consumer awareness about Apple Products, creating and increasing brand value, and increasing sales for the *Apple* products.



Figure 20: Apple Store in New York

The advantages of an exclusive retail outlet are manifold and include:

- **Increasing Product Awareness and Education**
As in the case of an Apple Store showcasing new products— having the customer walk in and be able to see a product can help to increase the product awareness. With hands-on experience, the customer can see the actual size of the system, its corresponding parts, the ease of installation, and become educated on various aspects of the Product.
- **Advertising and Brand Building –Product Marketing**
The retail outlet helps to advertise the Product and differentiate it from competitors. A kiosk can help in brand building for the company and the Product.
- **Different Services under One Roof - Financing Help and Solutions**
The kiosks can serve as a one-stop-shop where GE can offer their associated energy efficiency products and services A one-stop-shop can help show the customer the cost benefits, offer financing solutions and help design, install and service (physical point of contact) the PV system.

An example of a clean energy company implementing parts of the recommended strategy is *Your Energy Solutions*, offering one of the only solar power and solar and energy efficiency product showrooms in Northern California. Customers can see various solar PV options, energy efficiency lights, tankless water heaters, Home Energy Management systems, and other clean energy solutions such as energy storage options available for their homes. The potential customer is able to view and discuss available options for solar panels and other power saving products with knowledgeable and experienced energy consultants/experts, discuss financing options, and increase their own awareness.



Figure 21: *Your Energy Solutions* has two retail showrooms in Pleasanton, CA and Rancho Cordova, CA¹⁹

15. Marketing Message

The integrated solar PV system needs to be marketed well with a clear and well-articulated message that highlights its advantages over competitor PV products. These include:

- Integrated Product Advantages
 - Plug and Play Advantages
 - Micro-inverter Advantages
 - reliability
 - easier installation
 - reduced costs of balance of system
 - Building Integrated PV

For GE in particular, the messaging should also highlight the GE brand:

- GE Brand: Trust and Reliability
 - GE credibility and brand awareness built over the last 100 years
 - National and Multinational Reputation
 - Reliability associated with GE Brand highlighting the product assurance associated with the GE brand as compared to a new off-shore manufacturer. This is especially important given the 20+ years of warranty and life expectancy associated with a PV system and its performance.

¹⁹ <http://yourenergysolutions.com/solar-power-store-locations-california/>

16. Extend Product Integration to offer DIY integrated Kits

Integrated PV product manufacturers can take integration further and offer a completely integrated solar PV system, where the system only needs to be plugged into an electric. The ‘plug and play’ model is a popular product design concept developed and working successfully in the consumer electronics industry. PV Plug-and-Play systems offer homeowners the option of purchasing a complete, pre-packaged solar PV system that can be set up at low cost with relative ease making it possible to produce clean, renewable energy from the PV panels by simply plugging in the cord.

GE can build on its product’s integration of the PV system with the micro-inverter and add other auxiliary equipment to provide a completely integrated ‘Do-it-Yourself’ (DIY) kit that would further reduce the labor costs and installation time, and help differentiate their offerings from that of a competitor.

There are a number of companies across the world – such as *Centrosolar*, *Onyx* and *Westinghouse* that have already developed such kits and using the associated simplicity and convenience as a differentiating strategy in an already crowded PV market. For example, *Centrosolar* America, the U.S. subsidiary of *Centrosolar Group AG*, is taking its parent company’s “complete solar solutions” marketing approach to new levels in its efforts to expand its U.S. presence in an intensely competitive marketplace²⁰, as shown in the figure below.

²⁰ Greentech Media Research



Figure 22: DIY Complete Kit example – Centrosolar Example

In September 2011, Westinghouse announced the introduction of “all-in-one,” do-it-yourself (DIY) solar power system kits for the home²¹. As marketed by the Westinghouse press release: “The kits’ low cost and ease of installation make them “very appealing to contractors and do-it-yourself (DIY) homeowners who, until now, have been put off by the high price of a rooftop system.”

Each kit includes Westinghouse Solar AC panels with integrated racking and inverters, roof flashings and panel splices. Customers need to only add wiring to the rooftop and a circuit breaker in the home’s electrical service panel to start producing clean, renewable power. Though it’s targeting the DIY homeowner, as well as contractors, Westinghouse recommends that a licensed professional electrician take care of the wiring to ensure that it’s safe and meets code²².

Onyx Service and Solutions, a Colorado based company, also offers “all-in-one” 330 W Plug-N-Play solar PV system. Manufactured by “fabless” (Onyx’s Chinese manufacturing partner), the Onyx Plug-N-Play systems come with a 330-W panel, a built-in micro-inverter, and a standard U.S. AC power outlet plug. One system, the OSPP330-2, adds a high-capacity lithium battery that’s incorporated into the unit. Both Onyx’s Plug-N-Play solar PV systems are directed at the Do-It-Yourself (DIY) market. Onyx’s system takes the Plug n’ Play concept a step further by eliminating the need for costly wiring and installation by a

²¹ Source: Cleantechnica website: <http://cleantechnica.com/2011/09/26/westinghouse-solar-introduces-low-cost-all-in-one-home-solar-power-kits/#Te1f03BcKlZLHxAr.99>

<http://cleantechnica.com/2012/01/06/plug-n-play-solar-pv-systems-aim-to-juice-the-home-diy-market/>

²² <http://cleantechnica.com/2011/09/26/westinghouse-solar-introduces-low-cost-all-in-one-home-solar-power-kits/#3XDcC7tgxvrgwIGM.99>

professional electrician which significantly reduce the ‘balance of systems’ costs of purchasing and installing solar home PV systems:

“You can literally point the panel at the sun and plug an extension cord directly into the panel for immediate power – alleviating complicated wiring and typical installation requirements,” according to Greenwood, Colorado-based Onyx Service and Solutions’ press release. “The new panels are designed to be bought right off of the shelf in a hardware store, attached to any surface with 4 screws and immediately be put into service, powering a computer, fan, light or even a medical device. This new configuration will also help allow remote residences worldwide to have easier access to the power of the sun.”

G. II. CONSUMER VALUE MODEL

The following section further discusses the advantages of an integrated PV system and the opportunity and value it presents to the consumer.

The consumer being discussed has been divided into two categories - the end consumer and the intermediate consumer/s for the integrated PV product. The value model for the intermediate consumer and the end consumer differs, with regards to the value proposition and the actual differentiation and opportunity. The two types identified are:

- a. **Intermediate Consumer:** The intermediate consumer is the consumer at the middle and end of the solar value chain that would buy the PV system from the original manufacturer. This category includes the distributors as well as the third party installers and financiers.
- b. **End Consumer:** The end consumer is the homeowner that has the integrated solar system installed on their roof

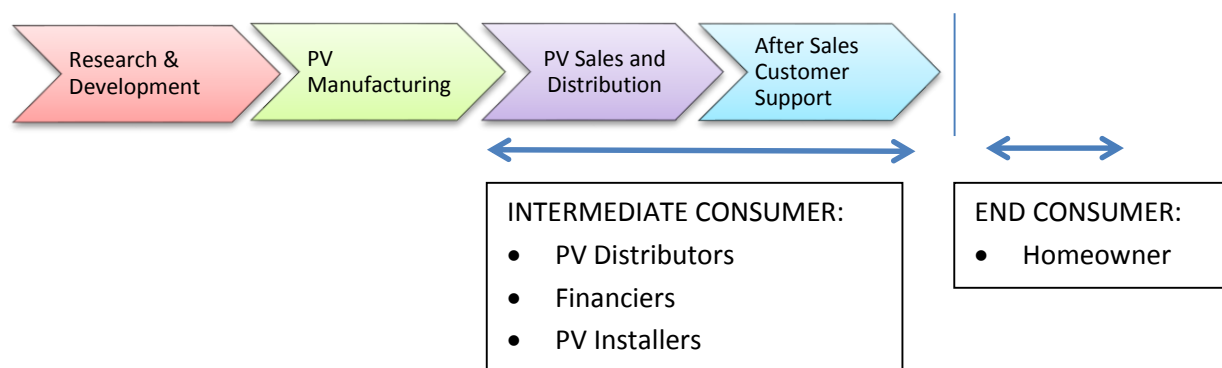


Figure 23: Two Consumer Categories

d. Value for the Intermediate Consumers – Distributors and Third Party Owners

One of the leading applications for the integrated solar PV product is in the residential retrofit market. The following section discusses this enormous market opportunity and the revenues and associated costs for the intermediate consumers. The intermediate consumers would be distributing, installing and financing the product to the end consumer (the homeowner) and need to be aware of the overall value the product provides because of the features discussed earlier.

17. Market Opportunity for Solar, Re-Roofing and Energy Efficiency Retrofits

The energy efficiency residential retrofit market in the U.S. and California presents an attractive opportunity and easily facilitates a sales and marketing approach that bundles an integrated PV system with other retrofit work. The integrated PV system's easier and quick installation saves time and money, and can be easily bundled with other retrofit services and products such as re-roofing.

Based on the latest US Census and the Deutsche Bank study, the number of single family homes in the US eligible for retrofit is estimated to be 48 million homes. This assumes that 88% are single family homes, out of which 61% are pre-1980 and assumed to be eligible for basic retrofit. Based on the 2011 US census, the number of California homes is almost 10% of the number of US homes. This can be extrapolated to almost 4.8 million pre-1980 single family homes in California alone. Because of higher income demographics, the number of retrofit eligible (pre-1980) or requiring a retrofit in California can be assumed to be an estimated 5 million homes.

Based on the level of retrofit—a basic roof retrofit or an energy efficiency retrofit—the overall potential market size can be estimated. The market opportunity can be estimated assuming a realistic market penetration and market share (factoring in competition) over an estimated time. For example, a simple energy efficiency retrofit of \$5,000 in 10% of the potential homes, can amount to a market size of \$2.5 Billion.

The following table from a Deutsche Bank report on the residential retrofit market in the United States summarizes the required invested capital and an estimated energy savings of \$144 Billion for single family residential retrofits in the United States.

	Single Family	2-4 Unit Building	5+ Unit building	Mobile Home	Total
Energy Savings (TBtu annually)	1,497	173	174	48	1892
Total Investment (\$B)	\$144	\$16.6	\$16.7	\$4.7	\$182

Source: Rockefeller Foundation, 2012.

Table 3: Summary of Estimated Energy Savings and Invested Capital Required in Each Segment of the Residential Market

The potential revenues that can be generated can vary based on the extent of retrofit and the solar PV system installed. The following section discusses the revenue generation avenues, and the associated costs— all supporting and highlighting the tremendous future business opportunity this segment presents.

18. Revenues and Costs

There are a number of potential revenue streams possible for the integrated PV system that includes installation, roof retrofitting and possible energy efficiency retrofits. Important costs that need to be

considered depend on the intermediate consumer and their role in the value chain and the level of vertical integration. These costs include:

- Sales, Marketing and Distribution Costs
- New Product training Costs: The integrated system is a newer product and although it has a smaller learning curve, the installers still need to be trained.
- Installation labor costs
- After Sales Service Costs – Technical and Customer Support
- After Sales Maintenance Costs – dependent on the contract and warranty being offered
- Grid maintenance costs that affect its use as a smart grid connected product. (These costs may be covered by the utility.)

Other costs could be related to the intellectual property, financial, physical infrastructure, and human resources. Intellectual property (IP), such as patents, branding, and other proprietary knowledge such as permitting knowledge are mainly allocated to the manufacturer during R&D but could also be associated with the processes and IP deployed across the value chain – for example, PPA and other financing contracts.

The figure below show costs associated with each step of the value chain:

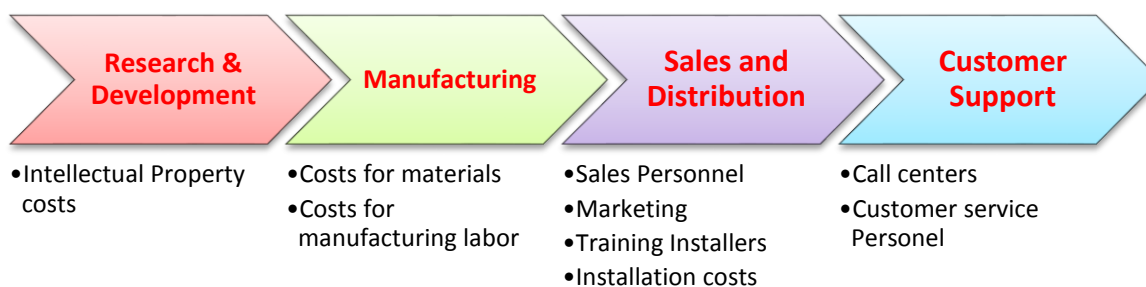


Figure 24: Costs Associated with Each Step of the Value Chain

e. Value for the End Consumers

The integrated PV system saves the end consumer time because the simplicity and ease of installation means their involvement in the overall buying and installation process is reduced. Their involvement can be further reduced if the installation has been bundled with an already existing re-roofing or an energy efficiency retrofit. Some installers may pass on the savings of reduced installation costs onto the end consumer resulting in additional cost savings.

Other end consumer motivations include: reduced reliance on conventional energy sources, reduced utility costs, and investment in long term energy cost stability. These motivations, coupled with a continual reduction in the PV system costs and a variety of financing mechanisms being offered help

alleviate the long standing barrier to solar adoption of high upfront cost . Solar PV, especially integrated solar PV systems, becomes an attractive value proposition for the end consumers.

19. Financing Options Enable End Consumer Adoption

One of the biggest barriers to large scale adoption of PVs has been the high upfront costs of a PV system and its installation. In recent years, a number of financing options have become available to the homeowners that have catalyzed the adoption of the PVs. These include finance and business model innovations such as Power Purchase Agreements (PPA) and leases through third party ownership models.

The financing options available to the consumer include:

1. **Loans** – Typical secured and unsecured loans are available through private lenders as well as government supported institutions.
2. **Rebates and Incentives** – A number of rebates and incentives are offered by the local, state and the federal government. These include incentives through the California Solar Initiative (CSI) a 30% federal tax credit (ITC), performance based incentives, and renewable energy certificates (REC).

20. New Innovations in Financing: Third Party Ownership

Innovative third party ownership (TPO) models – PPA and Leases, have been successful in increasing the adoption of residential solar PVs. These innovative business models allow the homeowner to not worry about the upfront costs of owning a PV while enjoying the benefits of a secure and clean energy source.

H. III. FEEDBACK FROM END CONSUMER and STAKEHOLDERS

BIRAenergy (ConSol)²³, in collaboration with SDG&E, gathered market feedback which was divided into two main sections:

- a) Market Assessment for identifying Test Homes for the GE Smart Grid Ready Solar Electric System
- b) Market Feedback on Solar PV from homeowners

f. Market Assessment for Identifying Test Homes

Market assessment survey responses showed a significant interest in obtaining solar energy and in volunteering as a test home for the Smart Grid Ready Solar Electric System. However, in the previously targeted regions (Climate Zones 14 and 15, dry-desert region), there were a limited number of homes that met the prototype system's requirements.

The primary limitation was found to be the required roof material. The prototype PV system was designed only for asphalt shingle roofs and most homes in these areas include membrane roof material or mission/barrel tiles.

After the first round of the survey, a home ("Showcase Home") in the City of Chula Vista was chosen for installation and demonstration. Marketing material –flyers and news releases– were developed for marketing this home.

g. Homeowner Market Feedback on Solar PV

BIRAenergy and SDG&E discussed various strategies to obtain market feedback on the PV retrofits and their viability for existing homeowners in the SDG&E territory. This led to developing and conducting an online survey to evaluate the existing market opportunities and construct the critical consumer decision-making metrics for solar and energy efficiency improvement retrofits. 655 homeowners were surveyed regarding barriers and limitations of installing a solar PV system to get their feedback, independently from identifying possible test homes for the GE prototype.

h. Marketing Flyers and Survey Design

The survey was designed to collect site information including: location, age, roof pitch (most homeowners won't know- maybe give a range of general descriptions [flat, steep, etc.]) roofing

²³ BIRAenergy and its lead team, started the project when it was part of ConSol in 2011. BIRAenergy has since then split-off from ConSol as a separate entity. Some of the work was thus conducted under the ConSol umbrella in 2011 and 2012.

BUSINESS MODEL – Plug and Play Solar PV Kit

materials and shading, and to create a scale, matrix or general set of questions to address the following items : importance of fixed cost of generated electricity, payback, cash flow and other decision influencing factors to better understand the drivers for consumer purchases of solar and efficiency retrofits

BIRAenergy (ConSol) reviewed some potential markets for homes that could be included in this project. A draft list of selection criteria was developed, which was reviewed and revised by program partners. The following evaluation criteria was used to identify candidate home's evaluation criteria as a potential test home:

- Resides in the SDG&E territory
- Must be the principal residence
- Able to provide access to utility bills
- Roof Type: Asphalt shingle
- At least 250 square feet of unobstructed roof area
- Minimal shading of roof area
- Roof area preferably between SE and SW (135°- 225°)


There was also a brief project description that was posted on the project website:



Figure 25: Webshot from the Project Page Created on BIRAenergy (ConSol) Website

BIRAenergy/ConSol also worked with SDG&E to contact their employees in order to identify candidate homes. Towards this effort, an advertisement was developed to be included as part of the April edition of SDG&E's internal monthly newsletter. This was distributed to SDG&E employees and some state employees at local jurisdictions. The announcement invited SDG&E employees living in SDG&E territory

to participate in this project. There was also a more detailed one-page flyer developed for distribution to interested homeowners.



Solar roofing is a crucial factor for zero net energy

Time to Reroof? Time to Think Solar!

Great rebates! Lower utility bills!

The California Solar Initiative (Go Solar California) awarded a contract to a partnership between ConSol and GE to conduct research on lowering the cost of roof-mounted solar systems with an innovative "plug and play" photovoltaic (PV) system developed by GE for the asphalt shingle reroofing market. Standard roofers will be able to quickly install this PV system without requiring any penetrations in the new shingles. Demonstrations will be conducted on six volunteer homes in SDG&E territory. In addition SDG&E ETP may fund other energy efficiency improvements in some of the homes to optimize the size the solar PV system and increase the energy efficiency of the homes.

Benefits:

- Lower cost than other roof-mounted PV systems
- Designed specifically for asphalt reroof projects
- Includes a GE in-home display
- Rebates and tax credits available

Requirements:

- First come, first-served (six homes only!)
- In need of new asphalt shingle roof
- Able to provide access to utility bills
- Ability to finance or purchase roof and PVs

For more information, please contact ConSol at csi-info@consol.ws.

Figure 26: Snapshot from SDG&E Monthly Newsletter April 2011

CSI RD&D Program

Cross-Cutting: Integration of Energy Efficiency, Demand Response and Energy Storage with PV



Low-Cost, Smart-Grid Ready Rooftop Solar Product Enables Residential Solar Energy Efficiency Results

ConSol

Partners: General Electric, SDG&E

Through a \$1 Million California Solar Initiative (CSI) Research, Demonstration and Deployment (RD&D) grant, ConSol, in partnership with GE and SDG&E, is conducting research aimed at testing GE's innovative new "plug-and-play" photovoltaic (PV) system developed specifically for asphalt-shingle roofs. The goal of this project is to field-test GE's low-cost solar retrofit product. The PV product, which includes a Home Energy Management (HEM) system from GE, will be installed on six homes within SDG&E service territory to determine its feasibility and impacts in different markets. One of the homes will be selected for a Zero Net Energy (ZNE) retrofit, which will include additional efficiency measures, GE's demand-responsive appliances, an integrated Home Energy Management system, and an energy storage system.



Key research activities include: 1) Evaluation of the installation costs, barriers, and performance of GE's new low-cost PV retrofit system; 2) Assessment of existing and potential financing options to cover the costs of the PV system, energy efficiency upgrades, and non-energy building retrofits (e.g. re-roof) in a single, readily available package; 3) Analysis of target markets and marketing materials for this PV retrofit system; 4) An assessment of the impact that this PV retrofit product, along with efficiency improvements and demand response capability will have on the utility distribution grid; 5) Development of a business plan for standard roofing and electrical contractors to add the installation of this PV retrofit system as a sustainable product offering, independent of the availability of incentives for renewable systems.

"Plug and Play" – 120Vac PV System



Plug and Play interface integrates mechanical and electrical installation



Look inside a Zero Energy Home




LEARN MORE:

One stop for all solar in California: GoSolarCalifornia.ca.gov

CSI RD&D website: CalSolarResearch.ca.gov


Figure 27: Developed Marketing Flyer on Integrated System

Now YOU can afford Solar!

Through the California Solar Initiative (Go Solar California) a partnership with ConSol, GE and SDG&E are focusing on lowering the cost of roof-mounted solar systems with an innovative “plug and play” photovoltaic (PV) system developed by GE for the asphalt shingle roofing market. Standard roofers will be able to quickly install this PV system without requiring any penetrations in the shingles. FREE demonstrations will be conducted on six volunteer homes in SDG&E territory. First come, first-served!

Benefits

- FREE 2.4 kW PV system
- Includes a GE energy monitoring system with online display
- Designed specifically for asphalt shingle roofs
- Lower energy bills



The image shows a laptop and a smartphone. The laptop screen displays a web interface for energy monitoring, featuring a 'Current' section with a value of 3.76, a 'History' section with a line graph, and a 'Status' section with a temperature of 68°F. The smartphone screen displays a similar mobile app interface with a value of 1.56.

Figure 28: Developed Flyer on Solar

The following graphic summarizes the survey design and the logic flow used for the survey for both identifying a potential test home, and for getting feedback from the homeowners on PV electric systems.

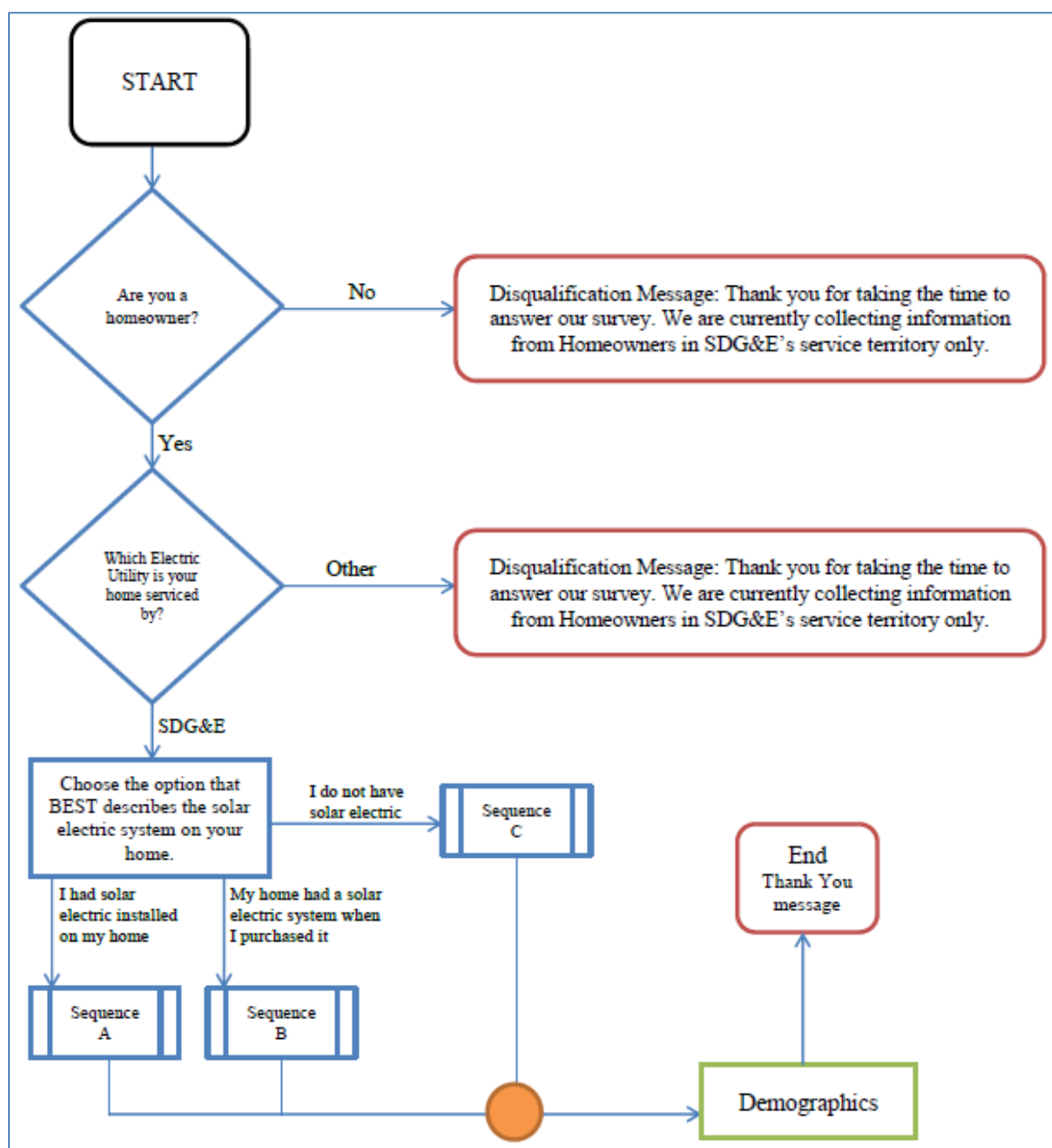


Figure 29: Survey Design Logic I

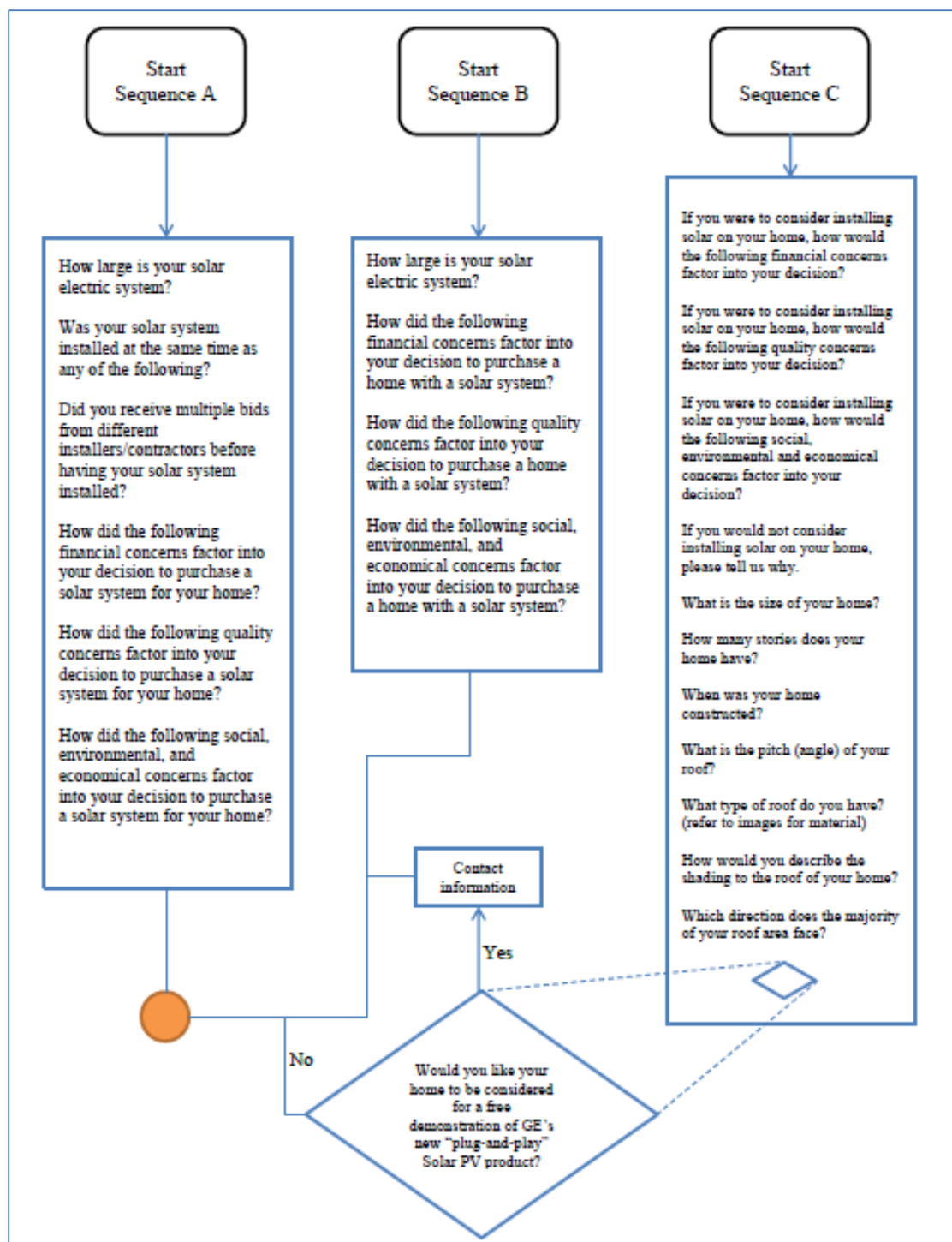


Figure 30: Survey Design Logic II

i. Survey Distribution

For the market assessment and surveys, BIRAenergy (ConSol) coordinated with SDG&E regarding distribution through their database of homeowners, as bill inserts and announcements of an online survey opportunity. However, it was eventually decided that the surveys would not be distributed by SDG&E directly.

Initially, survey responses were received rapidly with assistance and distribution from homeowner associations, local governments, and municipalities; however, the number of respondents peaked at less than one hundred responses. To acquire additional responses, BIRAenergy contracted a survey distribution company, Research Now, who provided the survey to their database of survey participants meeting the survey requirements (i.e., single-family, homeowners in the SDG&E territory). The survey participants were incentivized for completing the survey. Research Now was able to generate 598 completed surveys, resulting in a total of 655 completed surveys from which to complete the statistical analysis.

A demonstration home “Showcase Home” in the City of Chula Vista was chosen for demonstrating and showcase the integrated PV system from GE along with other emerging technologies. The following is a snapshot from the press release:



Figure 31: City of Chula Vista News Release on Demonstration Showcase Home

15 “Plug-and-Play” Solar PV System

Find out more about us at: www.energyupgradeCA.org

Overview:

Solar energy can effectively shift and reduce peak electricity use, lowering your electricity rate and bill.

Some innovative features of GE’s new low-cost “Plug-and-Play” solar product:

- Designed to be easily installed by standard roofing and electrical contractors
- Does not require any special installation tools
- Uses accepted methods for the flashing of rooftop penetrations resulting in a worry-free 20-year warranty that covers both the system and the roof
- Includes a unique comprehensive energy management system with Home Energy Monitor and Demand Response Controller, allowing you complete control over your home’s energy system.

This “PV Appliance” approaches a \$4.50/Watt installed cost, so a 4.8 kilowatt system could actually earn you \$107 per month!

3 Defining Elements

energy upgrade
CALIFORNIA
COMMUNITY SAVING INITIATIVE

Logos: OAKLAND, CONSOL, SDGE, GE, energy upgrade

Figure 32: Open House Marketing Flyer for the Showcase Home – “Plug-and-Play” Solar PV System

j. Survey Results

The evaluation of the survey results helped identify the candidates for solar retrofits based on the homes’ orientation and shading; the relative importance of fixed cost of generated electricity, payback, cash flow, and other decision influencing factors to better understand the drivers for consumer purchase of solar efficiency retrofits; and potential homes that could be used as test homes.

The following figures chart the survey results.

Are you a Homeowner?



		Response Percent	Response Count
Yes		89.2%	668
No		10.8%	81
answered question			749
skipped question			1

Figure 33: Survey Results, Chart 1

Which electric utility is your home serviced by?



		Response Percent	Response Count
San Diego Gas and Electric (SDG&E)		98.2%	655
Other		1.8%	12
If 'Other', please specify:			11
answered question			667

Figure 34: Survey Results, Chart 2

4. Chose the option that BEST describes the solar electric System on your home.




		Response Percent	Response Count
I do not have solar electric.		92.2%	604
I had solar electric installed on my home.		7.5%	49
My home had a solar electric system when I purchased it.		0.3%	2
answered question			655
skipped question			95

Figure 35: Survey Results, Chart 3

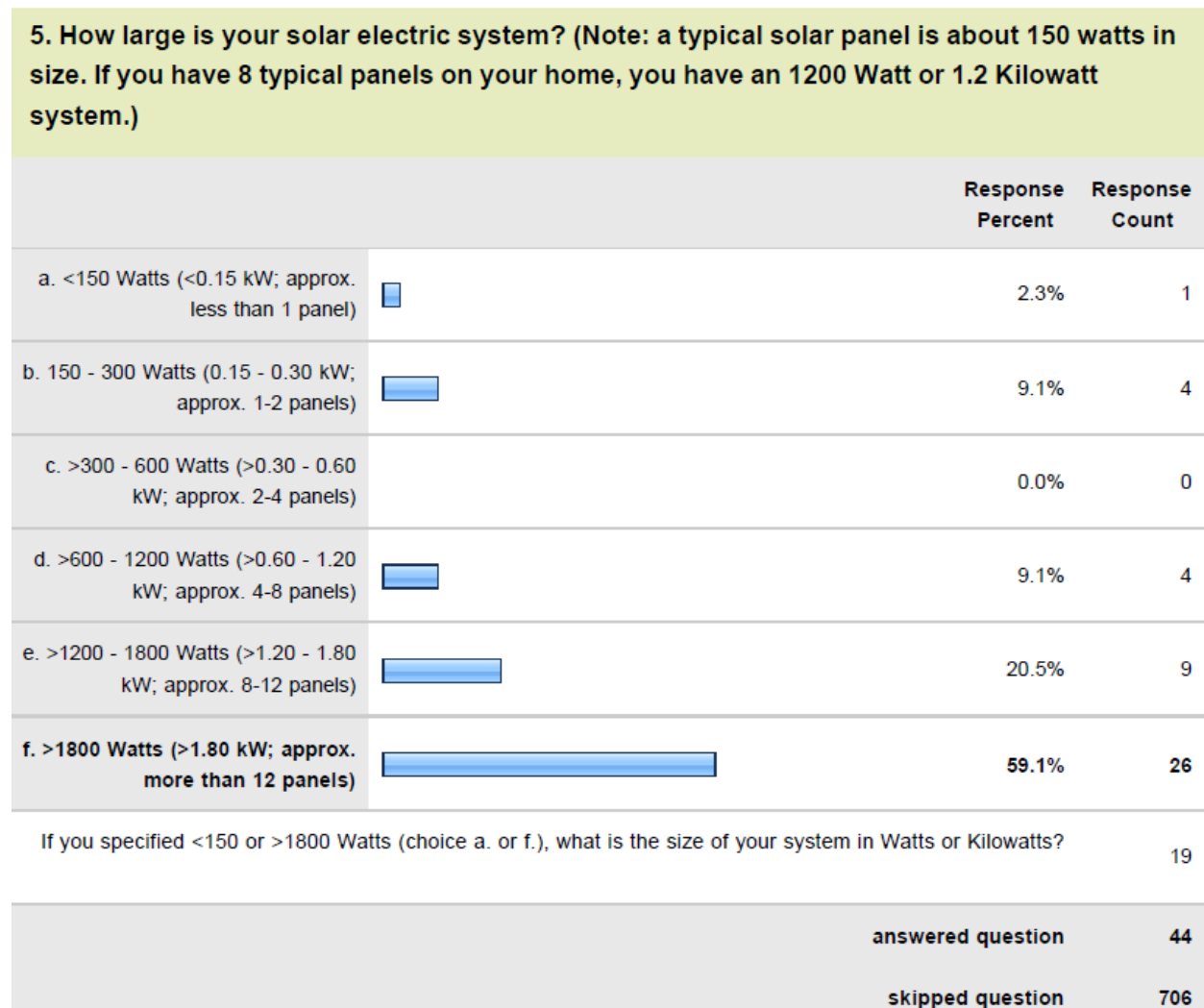


Figure 36: Survey Results, Chart 4

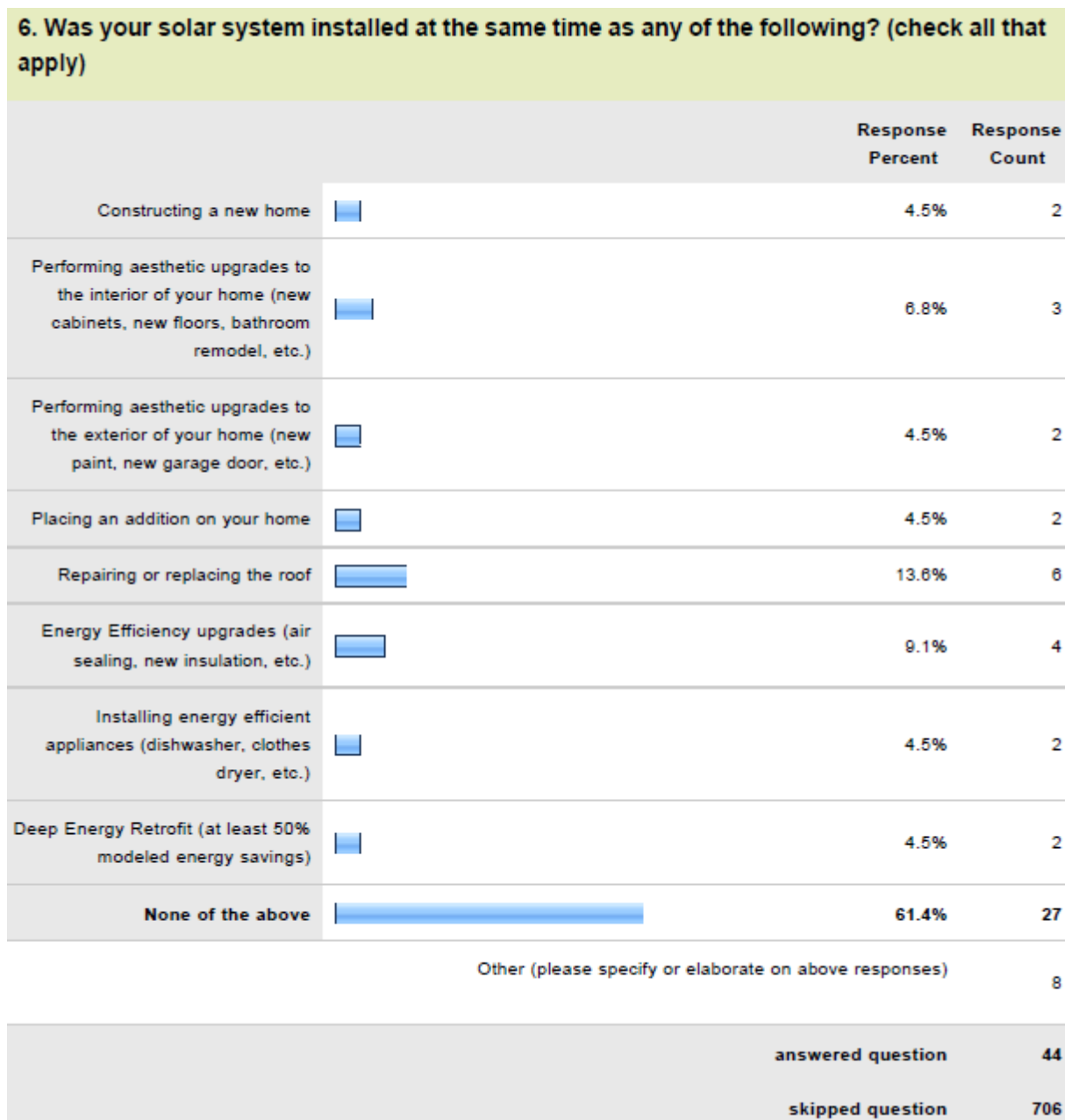


Figure 37: Survey Results, Chart 5



Figure 38: Survey Results, Chart 6

8. How did the following financial concerns factor into your decision to purchase a solar system for your home?						
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	Rating Count
Resale value of your home	31.1% (14)	33.3% (15)	24.4% (11)	6.7% (3)	4.4% (2)	45
Initial cost of solar electric system	57.8% (26)	37.8% (17)	4.4% (2)	0.0% (0)	0.0% (0)	45
Money saved on energy bills	86.7% (39)	11.1% (5)	0.0% (0)	2.2% (1)	0.0% (0)	45
Availability of rebate incentives	62.2% (28)	24.4% (11)	4.4% (2)	2.2% (1)	6.7% (3)	45
Availability of tax incentives	64.4% (29)	20.0% (9)	4.4% (2)	8.9% (4)	2.2% (1)	45
Amount of rebate incentives	62.2% (28)	26.7% (12)	4.4% (2)	2.2% (1)	4.4% (2)	45
Amount of tax incentives	64.4% (29)	22.2% (10)	2.2% (1)	8.9% (4)	2.2% (1)	45
Effect on property taxes	17.8% (8)	24.4% (11)	24.4% (11)	17.8% (8)	15.6% (7)	45
Having a positive monthly cash flow	35.6% (16)	26.7% (12)	28.9% (13)	6.7% (3)	2.2% (1)	45
Payback period	40.0% (18)	42.2% (19)	8.9% (4)	6.7% (3)	2.2% (1)	45
Please provide any additional comments or financial concerns that were not addressed above.						5
answered question						45
skipped question						705

Figure 39: Survey Results, Chart 7

9. How did the following quality concerns factor into your decision to purchase a solar system for your home?						
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	Rating Count
Warranty on the product	68.9% (31)	26.7% (12)	2.2% (1)	2.2% (1)	0.0% (0)	45
Warranty on the installation	64.4% (29)	28.9% (13)	4.4% (2)	2.2% (1)	0.0% (0)	45
Quality of product	86.7% (39)	13.3% (6)	0.0% (0)	0.0% (0)	0.0% (0)	45
Quality of installation	75.6% (34)	22.2% (10)	2.2% (1)	0.0% (0)	0.0% (0)	45
Familiarity with installation company	28.9% (13)	40.0% (18)	26.7% (12)	4.4% (2)	0.0% (0)	45
Familiarity with solar electric product manufacturer	31.1% (14)	40.0% (18)	24.4% (11)	2.2% (1)	2.2% (1)	45
Background and experience of installer	66.7% (30)	26.7% (12)	4.4% (2)	2.2% (1)	0.0% (0)	45
Maintenance requirements	53.3% (24)	37.8% (17)	6.7% (3)	2.2% (1)	0.0% (0)	45
Ease of connection to utility	48.9% (22)	40.0% (18)	8.9% (4)	2.2% (1)	0.0% (0)	45
Site suitability, e.g. shading, orientation	68.9% (31)	17.8% (8)	13.3% (6)	0.0% (0)	0.0% (0)	45
Please provide any additional comments or quality concerns that were not addressed above.						0
answered question						45
skipped question						705

Figure 40: Survey Results, Chart 8

10. How did the following social, environmental and economical concerns factor into your decision to purchase a solar system for your home?						
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	Rating Count
Reduced carbon emissions	35.6% (16)	28.9% (13)	17.8% (8)	15.6% (7)	2.2% (1)	45
Reduced dependence on oil	44.4% (20)	31.1% (14)	11.1% (5)	11.1% (5)	2.2% (1)	45
Reduced carbon footprint	37.8% (17)	26.7% (12)	17.8% (8)	15.6% (7)	2.2% (1)	45
Reduced air pollution	35.6% (16)	28.9% (13)	22.2% (10)	11.1% (5)	2.2% (1)	45
"Right" thing to do	37.8% (17)	26.7% (12)	20.0% (9)	13.3% (6)	2.2% (1)	45
Aesthetics	11.1% (5)	51.1% (23)	24.4% (11)	11.1% (5)	2.2% (1)	45
Please provide any additional comments or social, environmental, or economical concerns that were not addressed above.						5
answered question						45
skipped question						705

Figure 41: Survey Results, Chart 9

15. If you were to consider installing solar on your home, how would the following financial concerns factor into your decision?							
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	I would not consider installing solar on my home	Rating Count
Resale value of your home	42.9% (246)	32.6% (187)	14.8% (85)	3.7% (21)	1.6% (9)	4.5% (26)	574
Initial cost of solar electric product	80.1% (460)	12.5% (72)	1.0% (6)	0.3% (2)	1.2% (7)	4.7% (27)	574
Money saved on energy bills	76.8% (441)	15.9% (91)	1.2% (7)	0.5% (3)	0.9% (5)	4.7% (27)	574
Availability of rebate incentives	64.3% (369)	27.0% (155)	2.8% (16)	0.5% (3)	0.9% (5)	4.5% (26)	574
Availability of tax incentives	63.4% (364)	25.6% (147)	5.1% (29)	0.5% (3)	0.9% (5)	4.5% (26)	574
Amount of rebate incentives	63.4% (364)	28.0% (161)	1.7% (10)	0.9% (5)	1.4% (8)	4.5% (26)	574
Amount of tax incentives	63.4% (364)	25.4% (146)	4.5% (26)	0.9% (5)	1.2% (7)	4.5% (26)	574
Effect on property taxes	52.4% (301)	30.8% (177)	8.0% (46)	2.3% (13)	1.7% (10)	4.7% (27)	574
Having a positive monthly cash flow	55.2% (317)	26.5% (152)	11.1% (64)	1.2% (7)	1.2% (7)	4.7% (27)	574
Payback period	65.5% (376)	23.5% (135)	3.3% (19)	1.7% (10)	1.4% (8)	4.5% (26)	574
Please provide any additional comments or financial concerns that were not addressed above.							574
answered question							574

Figure 42: Survey Results, Chart 10

16. If you were to consider installing solar on your home, how would the following quality concerns factor into your decision?							
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	I would not consider installing solar on my home	Rating Count
Warranty on the product	81.7% (469)	12.0% (69)	0.9% (5)	0.2% (1)	0.7% (4)	4.5% (26)	574
Warranty on the installation	82.1% (471)	11.5% (66)	0.9% (5)	0.3% (2)	0.7% (4)	4.5% (26)	574
Quality of product	86.6% (497)	7.5% (43)	0.5% (3)	0.2% (1)	0.7% (4)	4.5% (26)	574
Quality of installation	84.7% (486)	8.9% (51)	0.5% (3)	0.3% (2)	1.0% (6)	4.5% (26)	574
Familiarity with installation company	34.8% (200)	43.4% (249)	13.9% (80)	1.7% (10)	1.4% (8)	4.7% (27)	574
Familiarity with solar electric product manufacturer	34.1% (196)	44.8% (257)	12.9% (74)	2.1% (12)	1.6% (9)	4.5% (26)	574
Background and experience of installer	70.7% (406)	22.0% (126)	1.7% (10)	0.3% (2)	0.7% (4)	4.5% (26)	574
Maintenance requirements	74.9% (430)	18.3% (105)	1.4% (8)	0.2% (1)	0.7% (4)	4.5% (26)	574
Ease of connection to utility	65.2% (374)	26.7% (153)	2.4% (14)	0.3% (2)	0.9% (5)	4.5% (26)	574
Site suitability, e.g. shading, orientation	58.7% (337)	29.1% (167)	4.5% (26)	1.6% (9)	1.6% (9)	4.5% (26)	574
Please provide any additional comments or quality concerns that were not addressed above.							26
answered question							574

Figure 43: Survey Results, Chart 11

17. If you were to consider installing solar on your home, how did the following social, environmental and economical concerns factor into your decision?							
	Very Important	Moderately Important	Not Very Important	Not At All Important	Unsure	I would not consider installing solar on my home	Rating Count
Reduced carbon emissions	37.8% (217)	36.8% (211)	14.3% (82)	5.1% (29)	1.2% (7)	4.9% (28)	574
Reduced dependence on oil	43.6% (250)	38.5% (221)	8.9% (51)	3.8% (22)	0.9% (5)	4.4% (25)	574
Reduced carbon footprint	36.6% (210)	35.7% (205)	16.4% (94)	5.1% (29)	1.2% (7)	5.1% (29)	574
Reduced air pollution	39.4% (226)	38.9% (223)	12.4% (71)	3.7% (21)	1.2% (7)	4.5% (26)	574
"Right" thing to do	25.8% (148)	38.5% (221)	21.8% (125)	7.8% (45)	1.4% (8)	4.7% (27)	574
Aesthetics	27.9% (160)	40.1% (230)	19.7% (113)	7.0% (40)	1.0% (6)	4.4% (25)	574
Please provide any additional comments or social, environmental, or economical concerns that were not addressed above.							22
answered question							574
skipped question							176

Figure 44: Survey Results, Chart 12

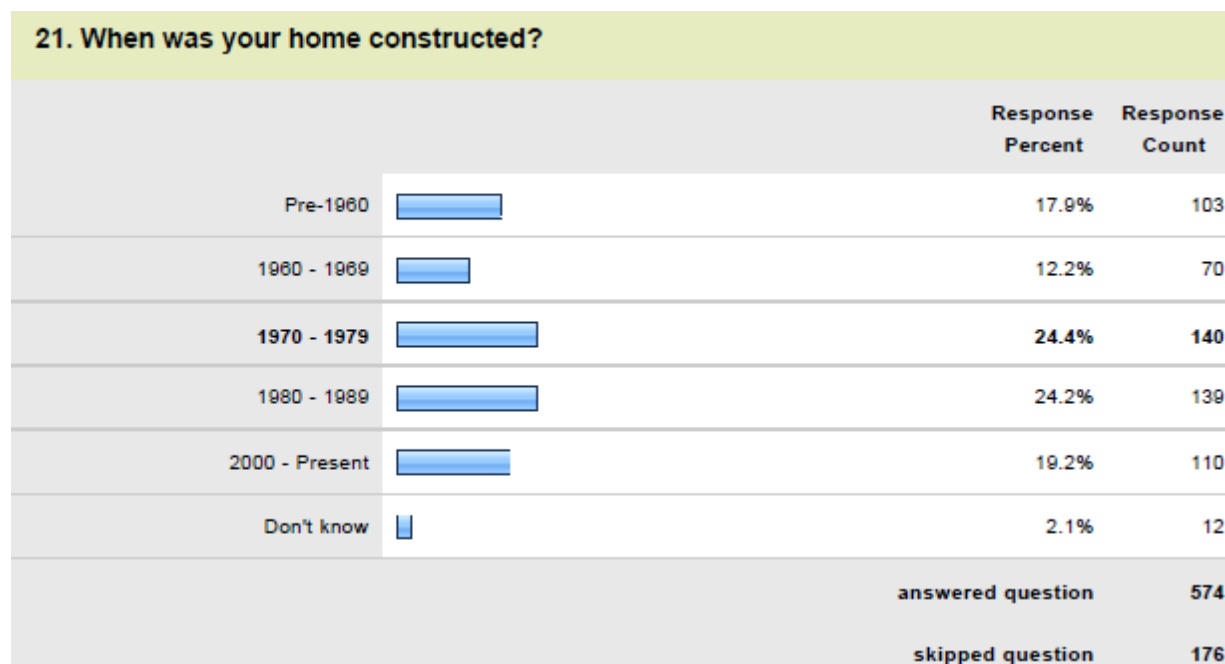


Figure 45: Survey Results, Chart 13

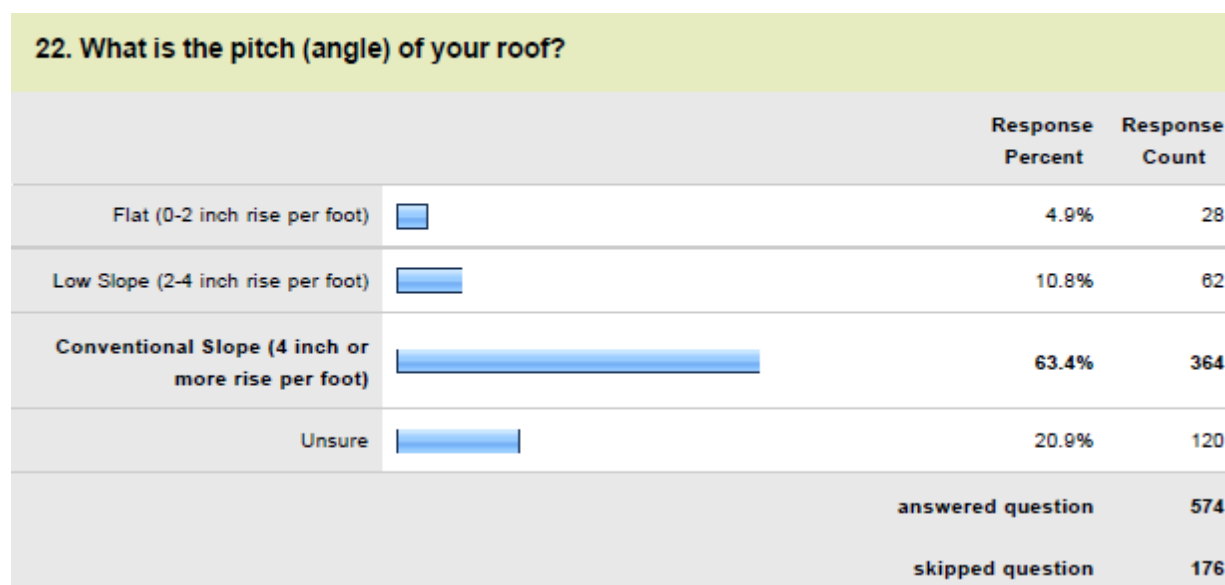


Figure 46: Survey Results, Chart 14

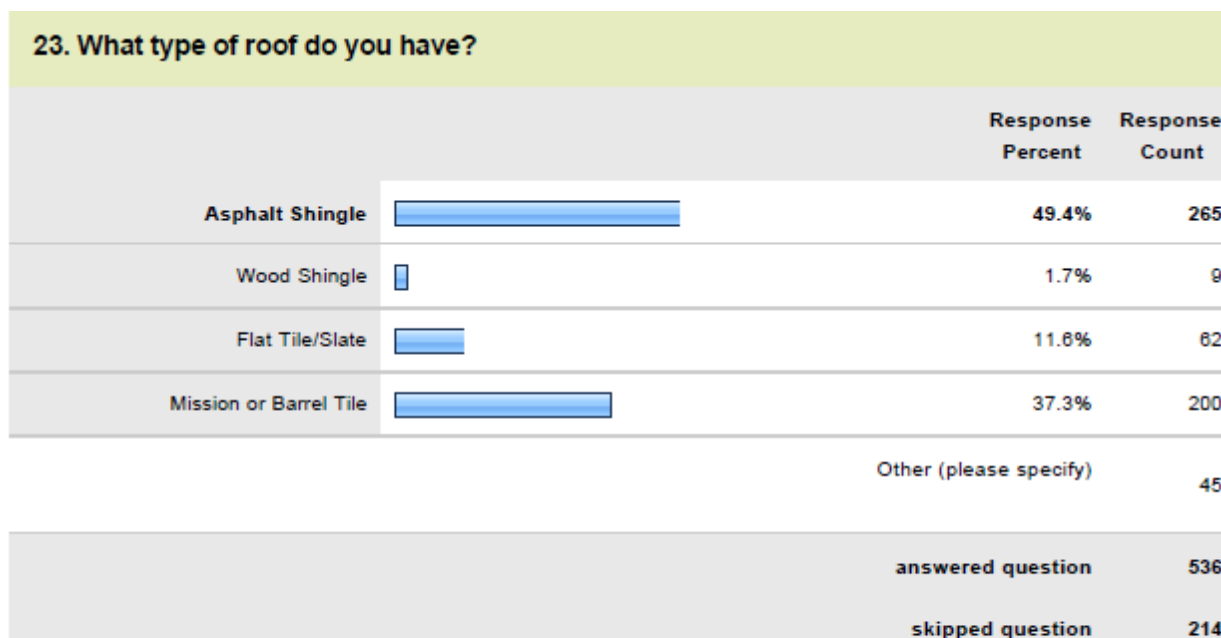


Figure 47: Survey Results, Chart 15

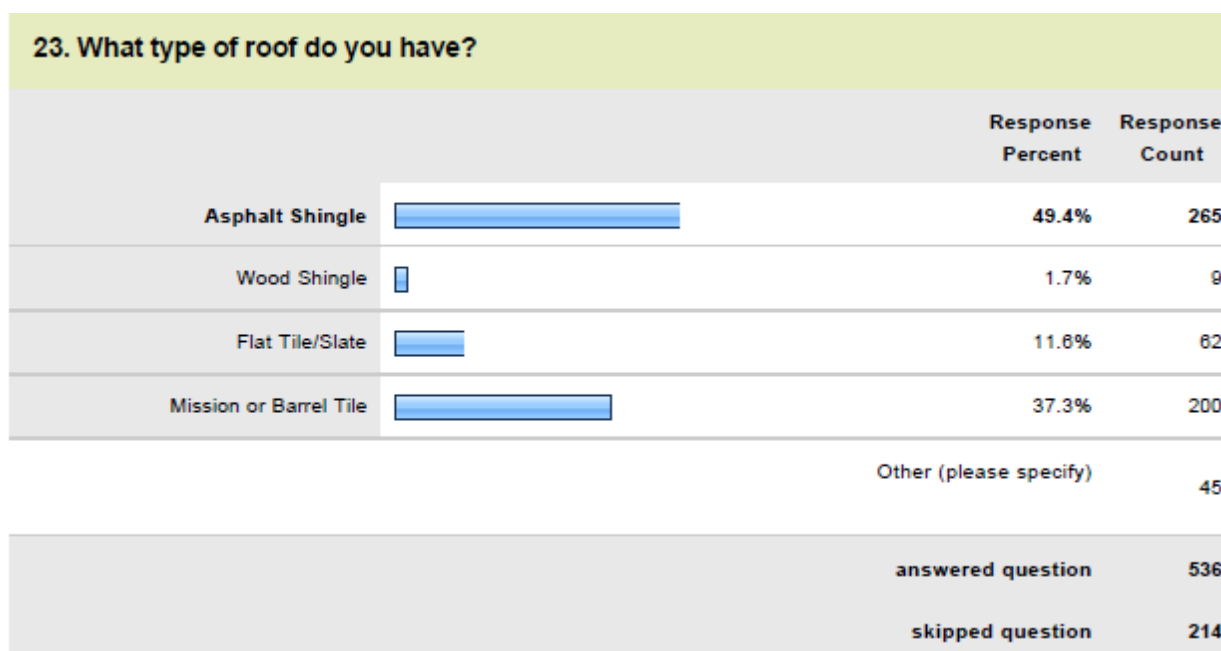


Figure 48: Survey Results, Chart 16

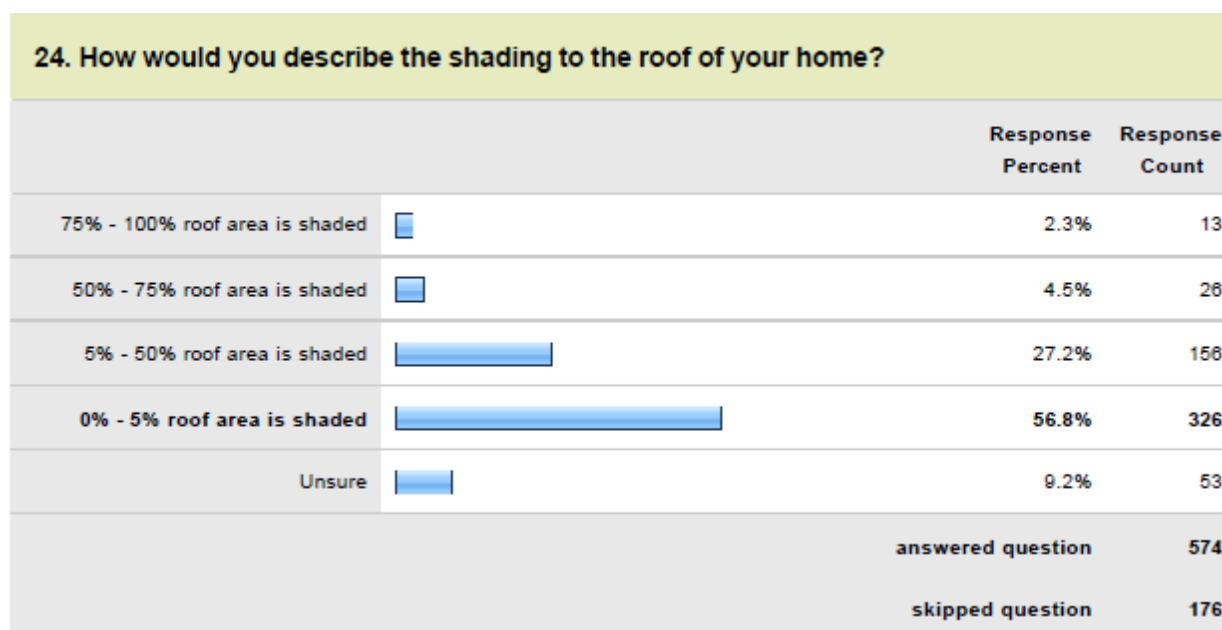


Figure 49: Survey Results, Chart 17

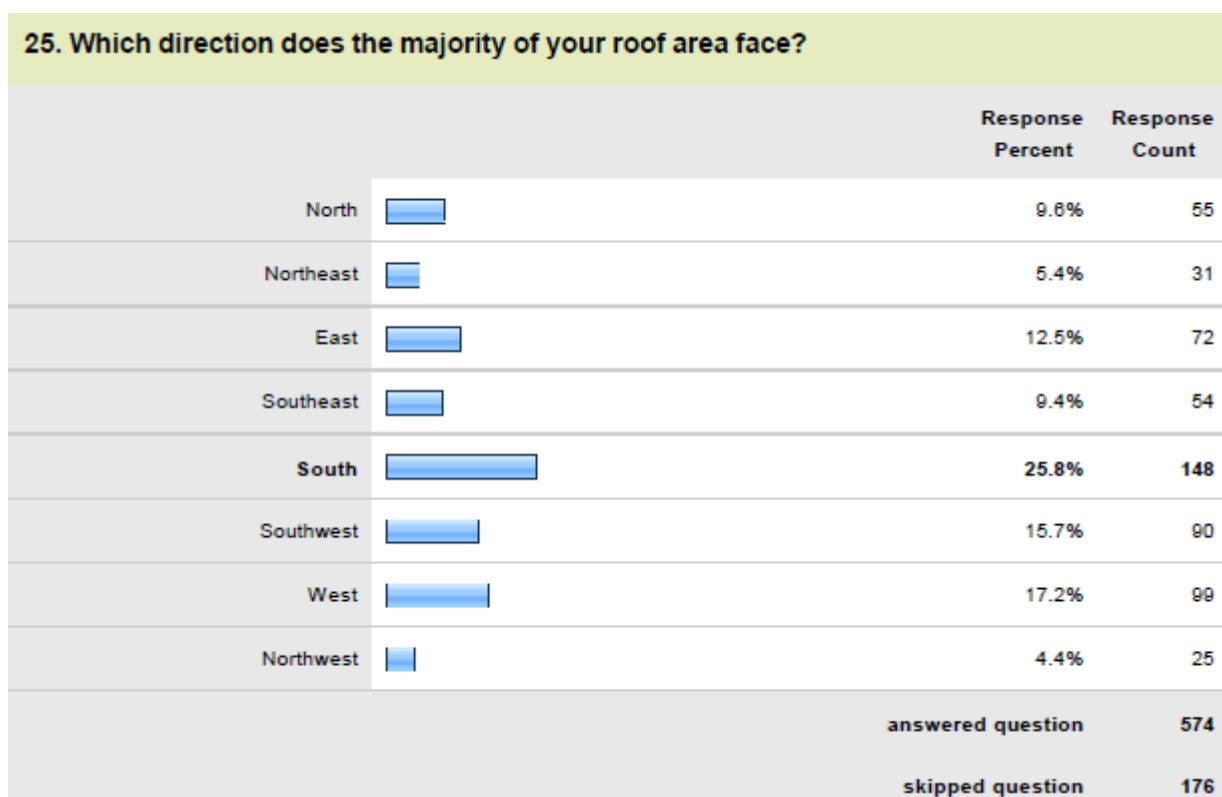


Figure 50: Survey Results, Chart 18

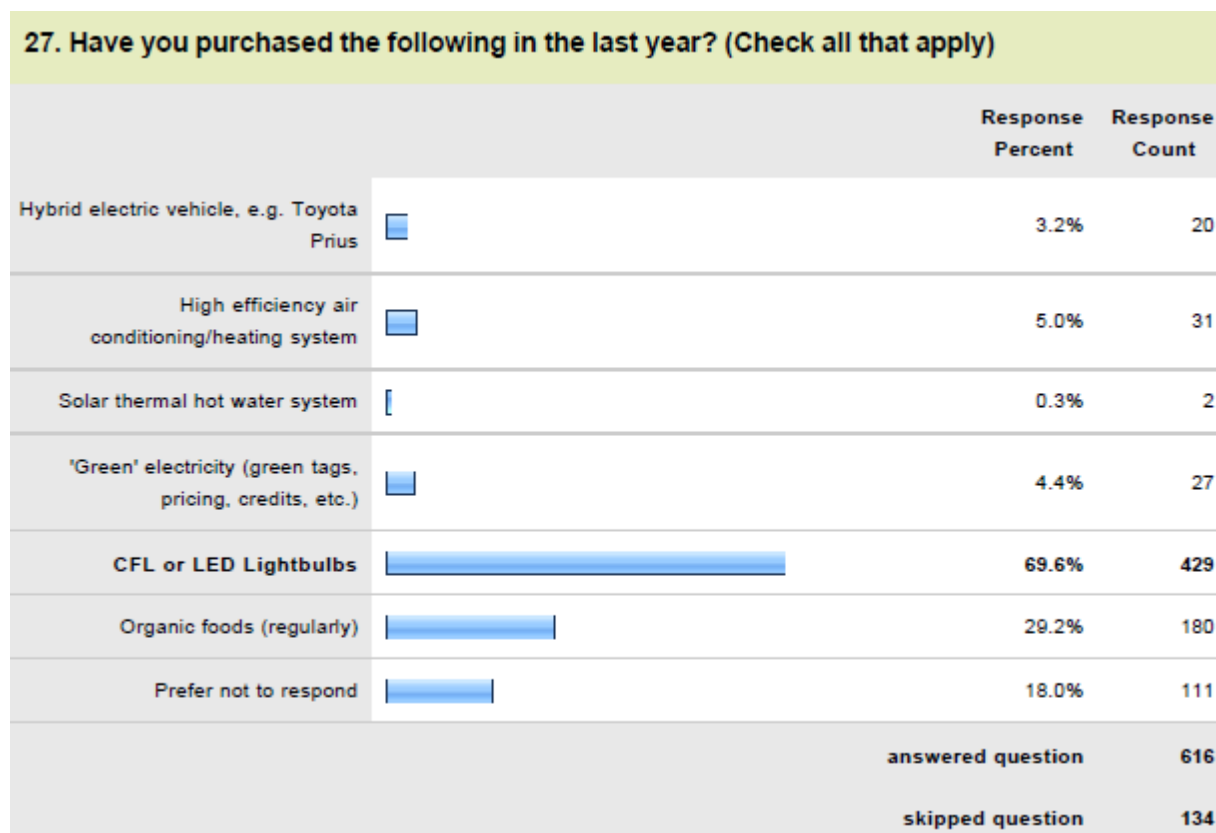


Figure 51: Survey Results, Chart 19

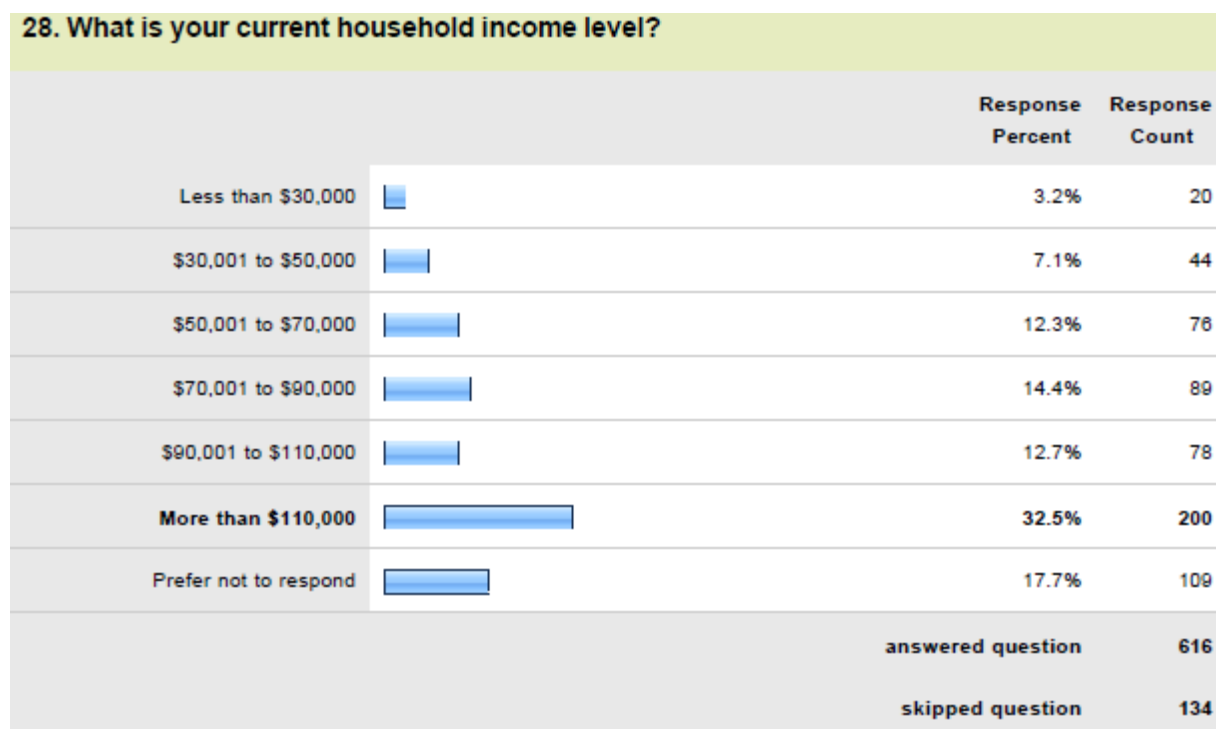


Figure 52: Survey Results, Chart 20

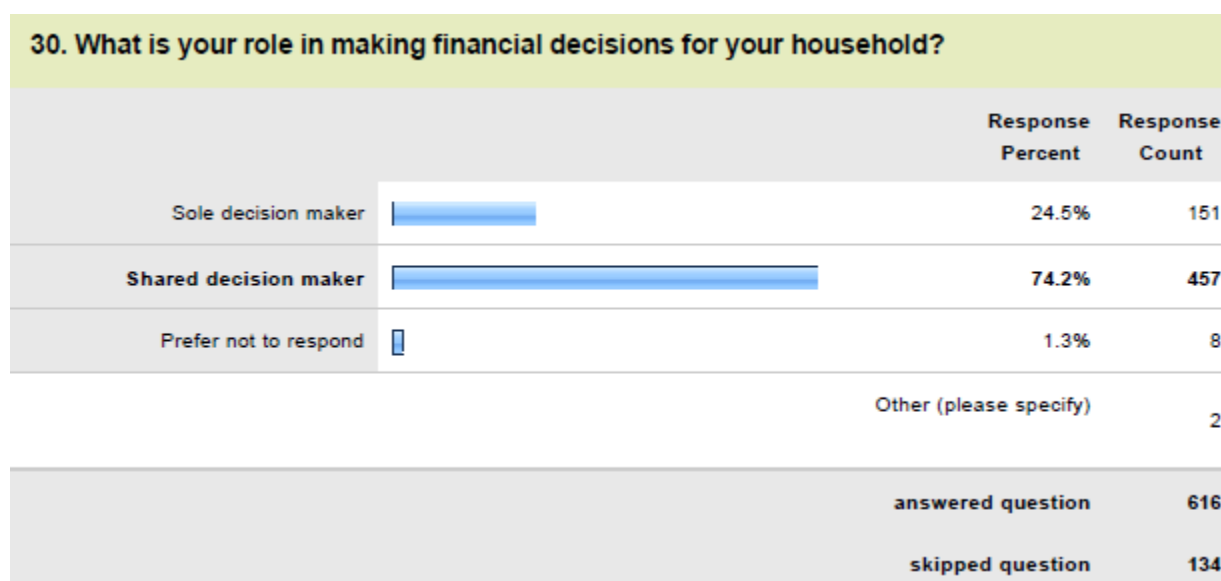


Figure 53: Survey Results, Chart 21

The market survey results showed that 70% of the people who gave reasons that they were uninterested in installing solar on their homes felt that way mainly because of cost effectiveness concerns.

Of the respondents who were surveyed, 92% respondents did not have a solar PV system. Of the 8% respondents, who did have a solar PV system, 59% had a system larger than 1.8kW. The main financial concerns and motivation that factored into the 8% who purchased the solar PV system were – the money saved on the energy bills, the initial cost of the solar PV system and the available tax and rebate incentives.

The quality of installation, the quality of the PV product and the associated warranties with the product and the installation, and the experience of the installer were the main quality concerns of the respondents with the solar PV system installed. These quality concerns were also the main quality concerns of those who did not have a solar PV system installed as yet, but if they were to consider the installation.

Due to the upfront cost concerns, many customers that could enjoy the benefits of solar are currently reluctant to adopt. They continue to pay the high price in a monthly utility bill. Those that opt for solar are paying for their systems through regular financing options and newer financing options such as power purchase agreements.

The advantage of owning the system outright, which is possible at the lower installation cost, should be emphasized in these cases. Financing options are still a possibility with this system, but are now not the only option. Financing the systems to avoid the upfront cost is a big incentive to most of our survey

respondents. Also, a lower initial cost can be more readily offset by energy savings using the same financing mechanisms used by traditional solar PV installations.

Contributions to the revenue streams include solar installations that happen in conjunction with re-roofs, which are expected to be the number one contributor to overall revenues, and solar installations alone, which are expected to be a secondary contributor. Post-installation support is not expected to contribute significant revenue.

21. Classifying the Home Characteristics

The homeowners were asked questions about their home's size and year of construction to understand the survey pool. Over half the homes were constructed before 1980, making them ideal candidates for retrofitting.

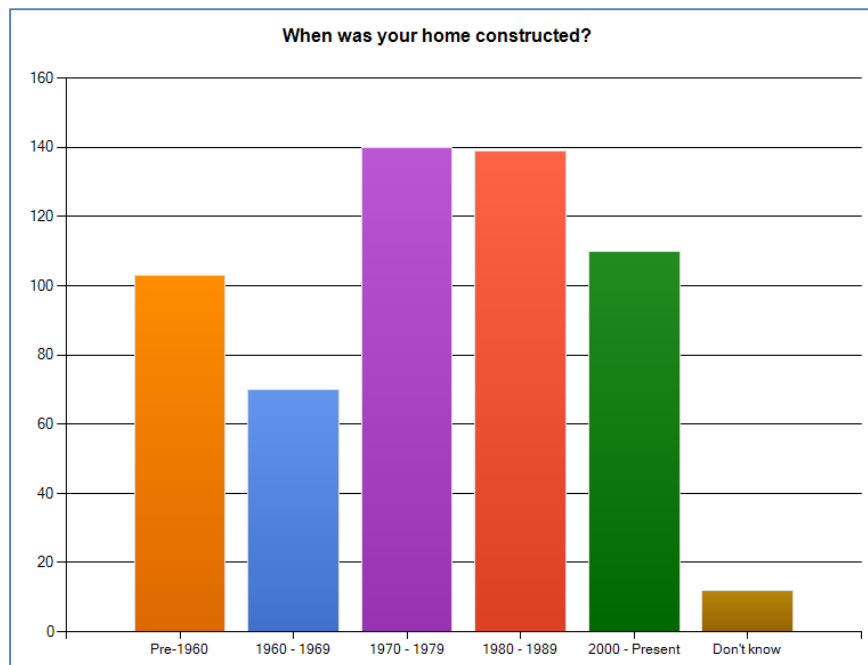


Figure 54 26: Results Graph: Year of Home Construction

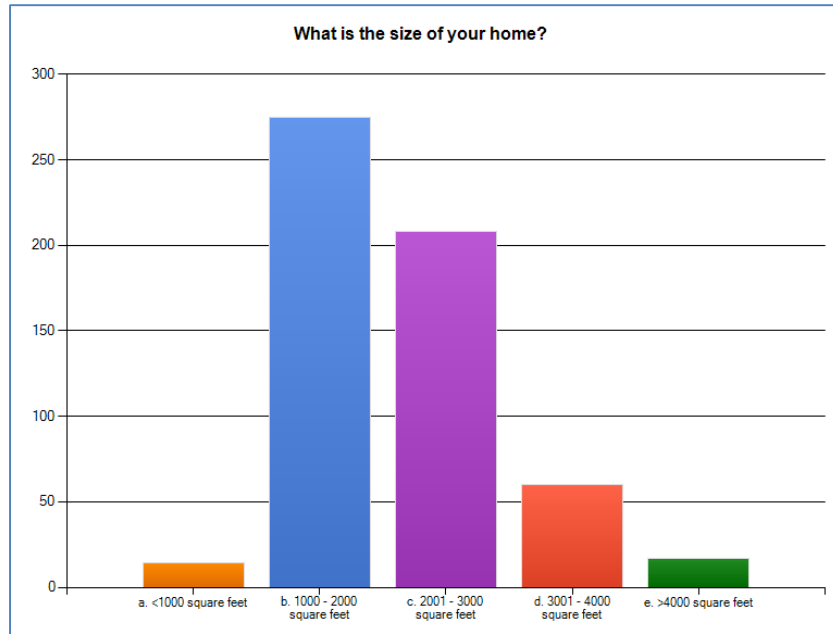


Figure 55: Results Graph: Home Sizes

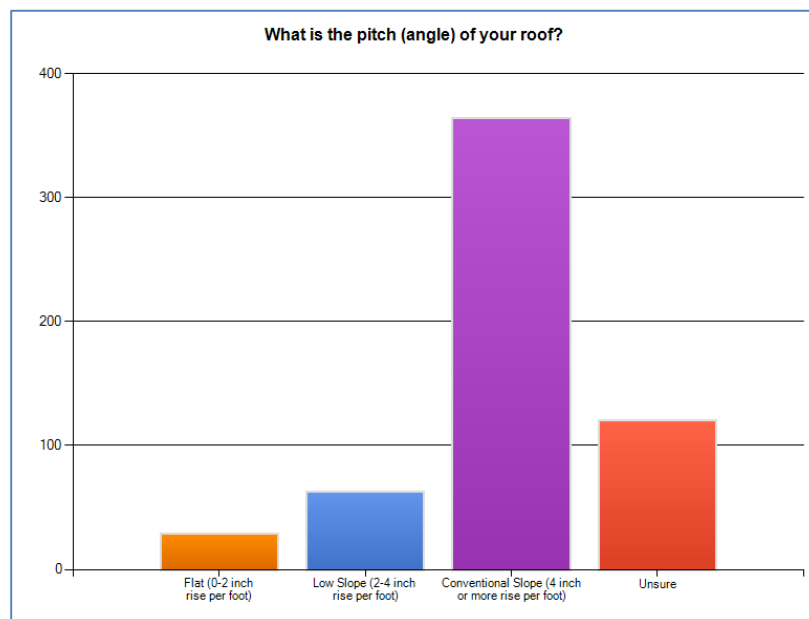


Figure 56: Results Graph: Roof Pitch

22. Solar PV Market Penetration

The first question of the market survey was intended to sort homeowners into those that had solar PV on their homes and those that did not (and would therefore be potential customers). Over 90 percent of homeowners who took the survey did not have solar electric installed on their homes.

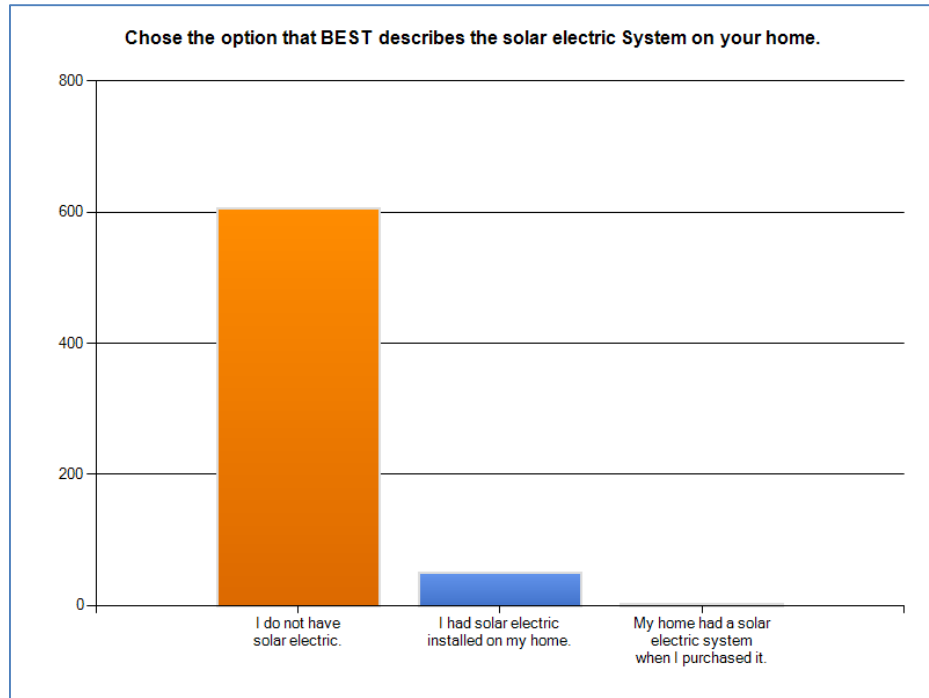


Figure 57: Results Graph: Current Solar System Presence

The above results show how over 90% of the surveyed homeowners did not have a solar electric PV system. This shows the enormous market opportunity that exists for installation of solar PV in existing homes. The rest of the questions delved deeper into the reasons for such a low penetration of solar PV.

23. Installation Triggers and Timing

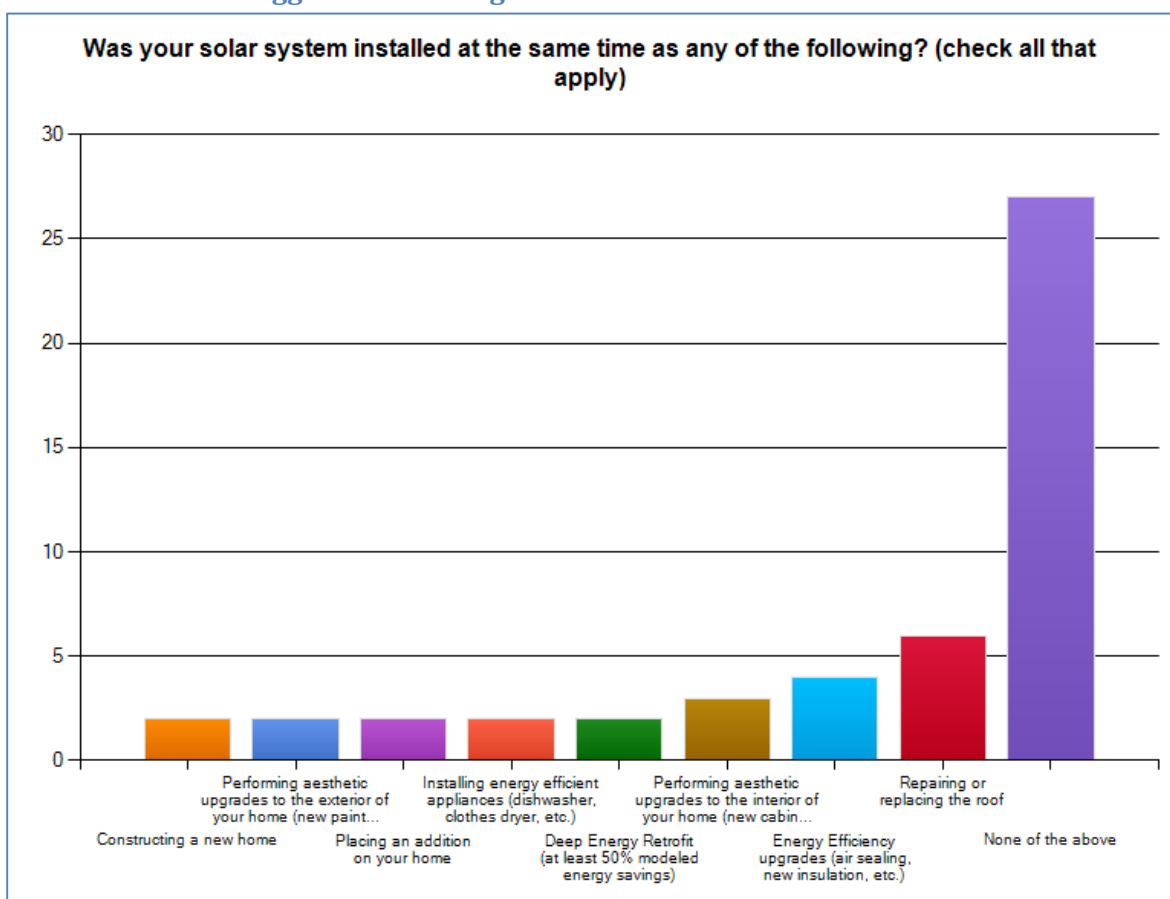


Figure 58: Results Graph: Solar PV Triggers

The above results show when the small percentage of respondents with a solar PV system, had their solar PV system installed. There were a few who identified re-roofing and energy efficiency retrofits as a trigger for installing solar PV. Majority of the respondents installed the system, because they wanted to and not driven by another activity (roof repair or energy retrofit).

24. Decision Motivations for Solar PV – Financial, Social and Quality

The second question focused on understanding the motivations for the decision to purchase solar systems. These were divided into financial concerns, quality concerns, and social concerns.

viii. Financial Motivations

A noticeable difference was seen between the group that had purchased solar and those who had not. A higher percentage of those who had not purchased solar PV rated each of the financial concerns ‘Very Important’ or ‘Moderately Important’. This shows how financial concerns are the leading barrier for the purchase of a solar PV system. Thus those who have fewer financial concerns (or have access to financing) and are interested in solar are already purchasing it.

The two most important financial concerns that were identified are 1) the high Initial cost of the solar electric product, and 2) their impact and the money saved on energy bills. The order of importance is reversed between the two groups. Those without solar systems are more concerned with Initial cost than with any other concern.

The responses clearly show the importance of addressing customer’s concerns regarding financing. There is a clear need for the Solar PV providers to offer financing solutions or TPO options and for lenders and financial institutions to help with finance o reduce the high upfront costs.

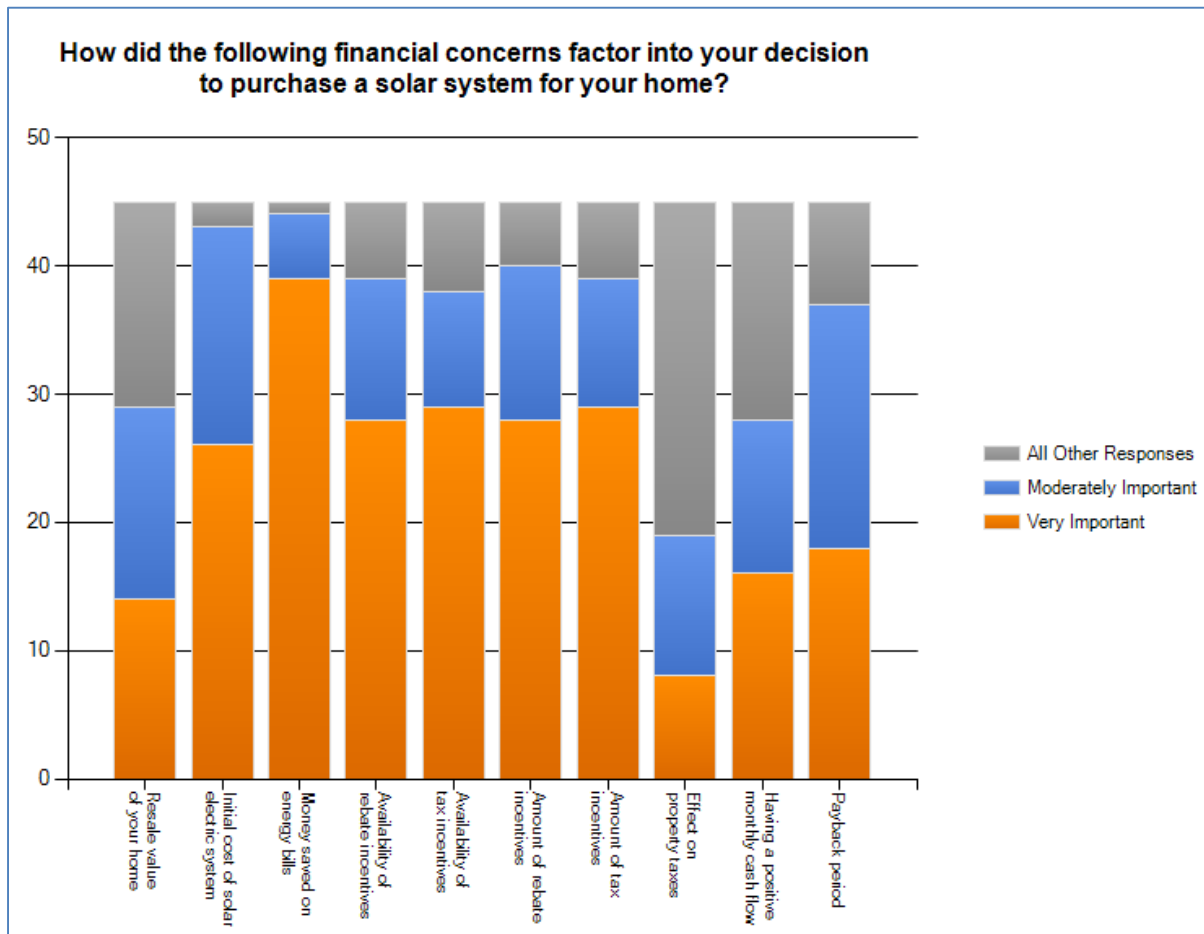


Figure 59: Results Graph: Classifying Financial Concerns

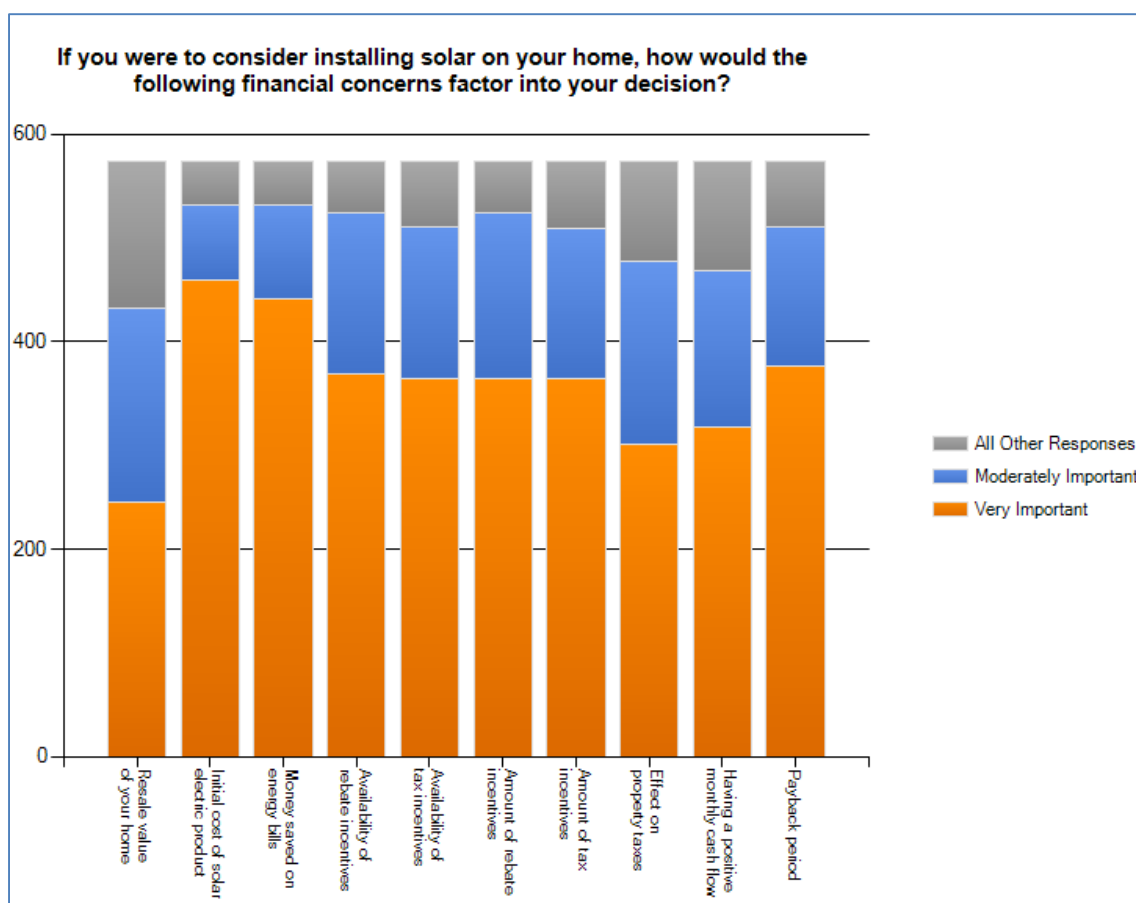


Figure 60 32: Results Graph: Impact of Financial Concerns

ix. Social motivations

Social motivations were the least important concerns compared with financial and quality concerns. Those who had already purchased solar ranked these slightly lower than those who did not.

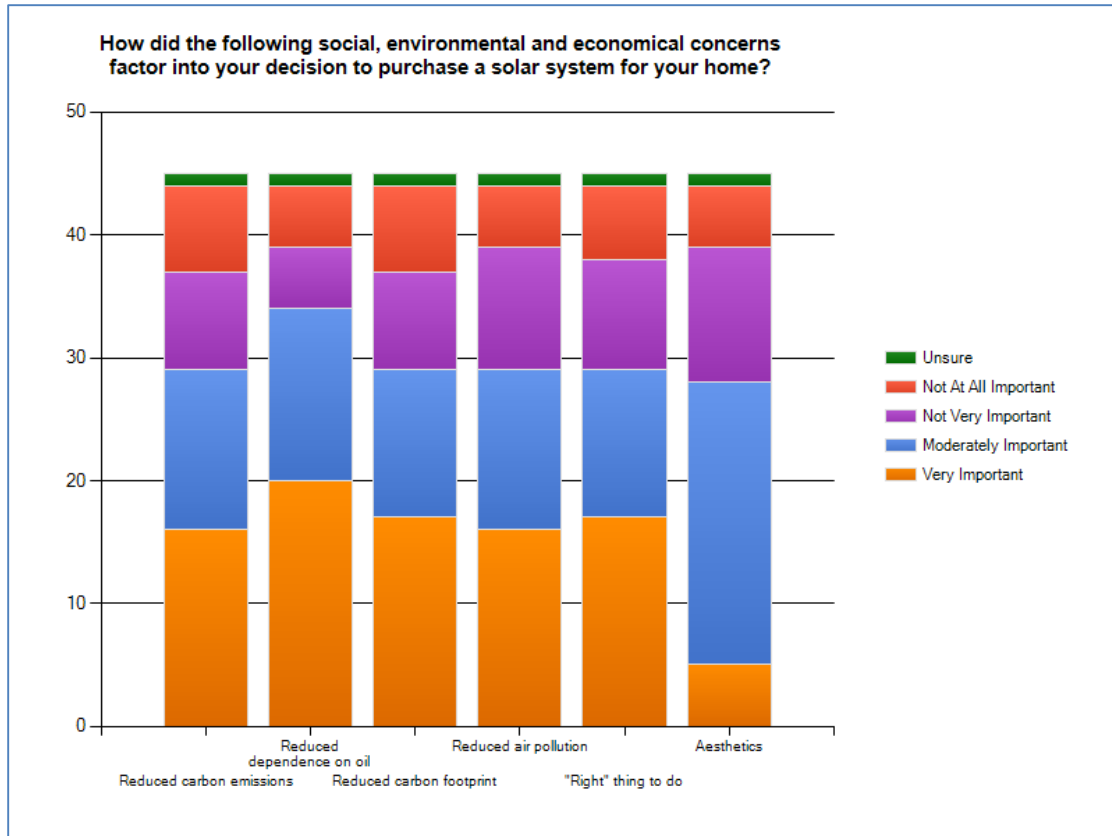


Figure 61: Results Graph: Comparing Various Concerns

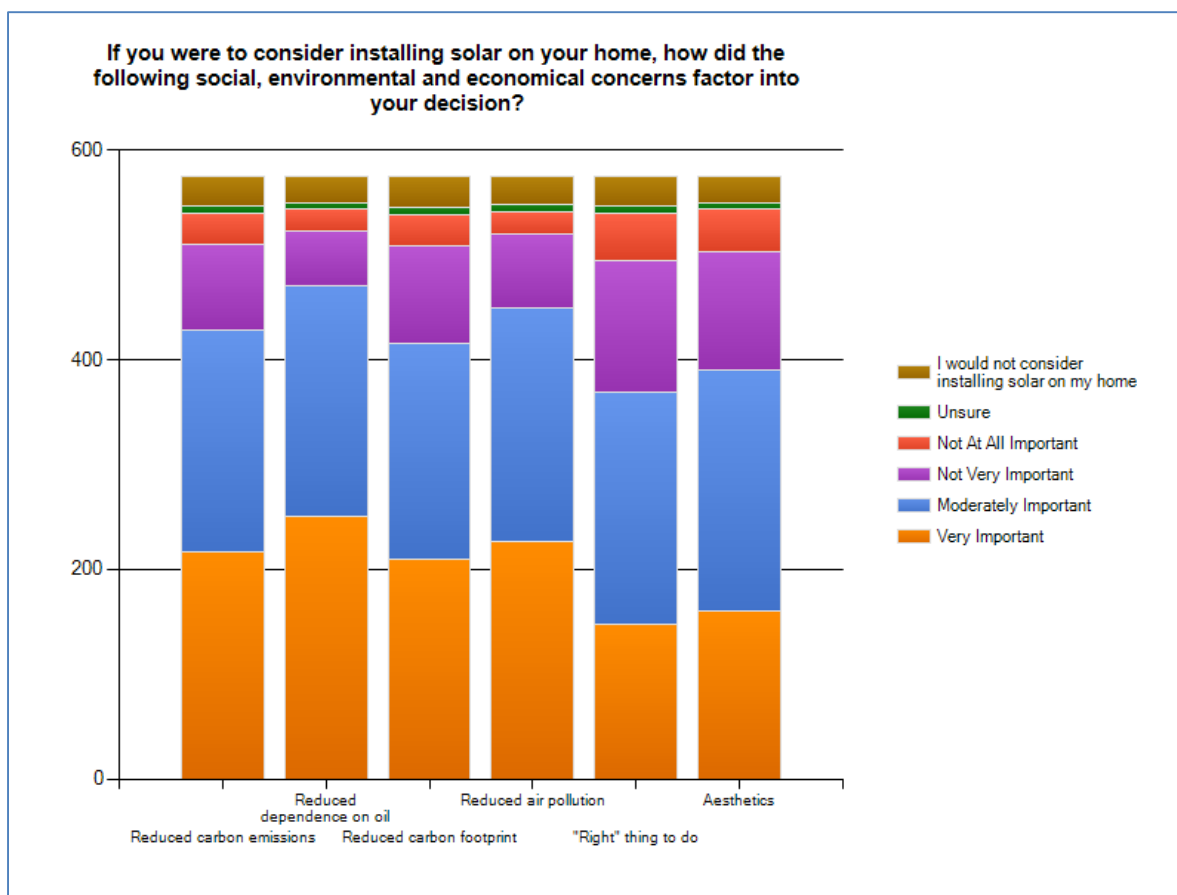


Figure 62 34: Results Graph: Decision Impact for Installing Solar PV

25. Free response Question

The free response question asked about other reasons respondents might not consider solar. This question revealed that 70% of those who answered (171 people, with 484 non-responses) pointed out their concerns about cost effectiveness. 11 of these respondents already have low energy bills and 13 were older people who feel that they were too old to achieve a payback. Four respondents cited current SDG&E policies.

k. Survey Conclusions

The survey helped identify and characterize (through a representative set) a typical customer (homeowners), their homes, and their feedback and motivation on solar PV systems. The customer responses support the business model and strategy recommendations discussed in the previous section. The following subsection details some of the lessons learned.:

26. Large Market Opportunity

With over 90% of surveyed homeowners not currently owning a solar PV system, there is a huge untapped market opportunity in the existing residential homes market for solar PV. Also, considering the informed responses on their motivations for not purchasing a solar PV system, it's clear that the homeowners are aware of solar PV systems and have thought about it, but are reluctant to take the plunge given the high upfront costs among other factors.

27. Financial Deterrents and Importance of Financial Solutions

The upfront cost of the solar PV system was identified as one of the biggest barrier to the adoption of solar PV systems. It is important for the solar PV providers to recognize this and offer various financing options to the homeowner by developing their own financing programs or through strategic partnerships with third party financiers and institutions.

28. Importance of Retrofit Channel

The retrofit channel – energy efficiency or roof retrofit – are two main channels that the PV providers should identify and leverage for marketing and deploying their systems, through cross selling, upselling and bundling their product with other retrofit solutions.

I. CONCLUSION

The report discusses the integrated solar PV product, business model and strategy recommendations for deploying the product, the market opportunity in the existing home market, and the consumer feedback from existing homes' owners.

l. Plug and Play Solar PV Kit has Significant Advantages

Plug-and-play, ready-to-install PV system kits, with integrated microinverters, such as the GE system, offer easier and faster installation, potentially increased reliability through integrated micro-inverters, and a 'plug and play' simplicity that makes them less expensive to purchase and install. These AC-PV systems also open the PV market to direct sales through the roofing trades and their sales channels, giving roofing contractors a substantial up-sell opportunity for both PV kits and the PV kits coupled with energy-efficiency upgrade packages. Further, the plug and play PV kits provide a large new, potential product offering of roofers' current products, providing a large opportunity for business expansion within the roofing contractor industry. Sales and installations of these plug-and-play PV kits could be made to homeowners either as part of the roofers normal re-roof sales process or as a new product and service offering from roofers – offering PV with energy-upgrade options as retrofit independent of re-roofing.

m. Large and Growing Solar PV Market Opportunity

The homeowner survey results, along with the cited research, show how the residential PV market offers an enormous market opportunity in terms of both size and potential growth. Differentiated product offerings such as the plug and play PV kit, are well positioned to take advantage of the market and capitalize on this opportunity.

n. More Innovative Business Model Strategies Required

The integrated solar PV system providers need to adopt and deploy the innovative business model and strategies across the value chains discussed in this report. This includes forming strategic partnerships, selling and marketing through varied marketing channels, deploying a well formulated marketing strategy and messaging, and offering the product through newer distribution channels.

o. Need to Focus on Residential Retrofit Market

The plug and play PV kit is well positioned for the residential retrofit market, an enormous market within the overall residential solar market. These PV systems can be bundled and cross-sold when a homeowner is getting an energy efficiency retrofit or with a re-roofing.


p. Bundle PV Systems with Financing Solutions

By addressing the long standing barrier of high upfront cost, new and innovative financing mechanisms such as the PPA and solar leases being offered through third-party financing have helped residential solar PV installations cross an inflection point in adoption. Concerns about financing, cost-effectiveness and payback period rank among the top concerns for homeowners who have not yet installed solar. The plug and play PV product provider should offer financing solutions when selling and marketing their products either through strategic partnerships with financiers and financial institutions or through vertical integration and business expansion.

q. Continue RD&D System Development

A robust and a continual product improvement will ensure that the product continues to enjoy differentiation by being the most innovative product in the rapidly growing competitive field.

Appendix I. SDG&E Newsletter – Reroof and Solar Message



SDGE
A Sempra Energy utility®

TechFLOW

Streaming New Technologies Into the Energy Efficiency and Demand Response Marketplace

April 2011
Emerging Technologies
Program (ETP)
Monthly Newsletter

Articles

CPUC and IOUs hold meeting to discuss State-wide ET Program.....Pg 1

San Diego Zoo to receive lighting and HVAC upgrades.....Pg 2

Smart Grid Integration at the Energy Innovation Center.....Pg 2

Solar Reroofing lowers utility bills.....Pg 2

Emerging Technologies Program Update

Ayat Osman of the California Public Utilities Commission Energy Division (CPUC ED) held a special meeting with the Investor Owned Utilities (IOU) ETP program staff on March 21st to discuss the kick-off the evaluation of the 2010-2012 Statewide ET Program. Ayat reiterated that the CPUC expects the ET programs to be aligned with the California Long Term Energy Efficiency Strategic Plan (CLTEESP). This will require the statewide program to balance the portfolios between short term needs and long-term goals. She also stated that utility portfolios should be balanced by market sectors and segments, program areas and alignment with the CLTEESP goals. The evaluators will examine how well are the feedback loops working within the utilities to properly track the technology transfer and traction of ET measures within the EE programs. The evaluators will also be examining how well the ET program is working in addressing:

- HVAC Initiatives
- Codes & Standards (C&S)
- Lighting Market Transformation (LMT) program
- Integrated Demand Side Management (IDSM)
- Zero-Net-Energy (ZNE) goals of the CLTEESP

The Statewide EE ETP Program Implementation Plan (PIP) for 2010-2012 was written collaboratively by the four IOU ETPs and it consists of six program areas. They are:

- Technology Assessment
- Demonstration and Showcase
- Technology Development Support
- Scaled Field Placements
- Market and Behavioral Studies
- Technology Incubation Support (TRIO)

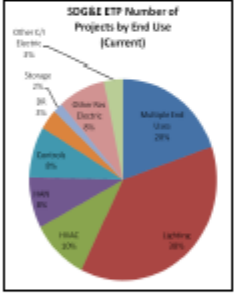
However, the majority of the SCG and SDG&E ETP program activities fall within the first three categories. The SDG&E DR ETP program is structured similarly. In order to be prepared for the CPUC ED evaluation effort, ETP has embarked on the following activities:

- Inventory all ETP projects (EE and DR) at each of the utilities (SDG&E/SCG) by category
- Expedite the completion of the ETP project database
- Examine the project inventory to categorize them by program areas, market sectors, timeline and connection to IDSM, C&S, LMT, HVAC, ZNE.

Our analysis of the EE and DR ETP has revealed that most of our portfolio is in lighting technologies. This is because lighting technologies are evolving quickly, and they typically make up the bulk of the “low hanging fruit” in energy renovation. There has been a few innovations in HVAC technology. Also, HVAC technology evaluation costs more and takes twice as long. Other observations included:

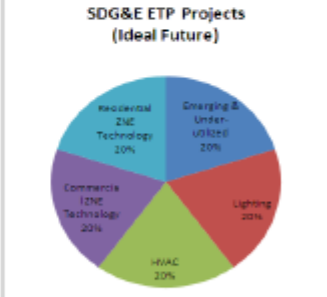
- There is a need for HVAC equipment and controls projects in the ETP portfolio. In 2011, ETP will be launching several HVAC and controls projects that will have both DR and EE benefits.
- A better diversified portfolio will be necessary in order to enable ZNE homes and commercial buildings to meet the CLTEESP goals.
- The SDG&E DR ETP is focused mainly on Home Area Networks and Advanced Building Management Systems. For Residential, ET conducted a market study to shortlist the top vendors from a field over 150 to assist technology assessments and other SDG&E HAN Pilots. After testing six vendors in five homes each, ET will transfer technologies to customer programs. In the future, ET DR plans to target energy storage, small commercial, and multi-family residences for DR technology applications.

As part of the CPUC ED directive, our project portfolio should be balanced such that 60% of the resources are dedicated to short and mid-term energy savings goals (Increased adoption of EE/DR measures and increase EE/DR technology supply) and 40% of resources are focused on long-term support of the CLTEESP and Big Bold Energy Efficiency Strategies (BBEES) such as ZNE commercial, ZNE residential, and HVAC.



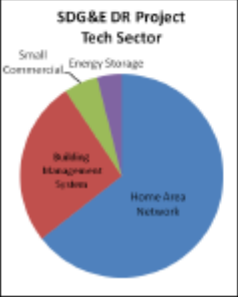
SDG&E ETP Number of Projects by End Use (Current)

End Use	Percentage
Lighting	35%
Other EE	25%
Storage	20%
Other HVAC	10%
Commercial	5%
HVAC	5%



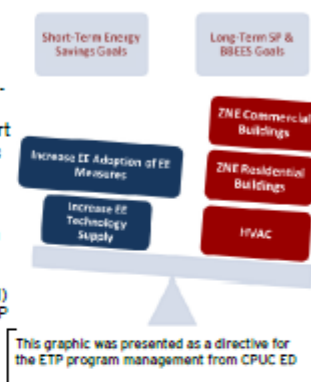
SDG&E ETP Projects (Ideal Future)

End Use	Percentage
Lighting	20%
Emerging & Unproven	20%
Commercial HVAC Technology	20%
Residential HVAC Technology	20%
HVAC	20%



SDG&E DR Project Tech Sector

Tech Sector	Percentage
Home Area Network	40%
Building Management Systems	30%
Small Commercial	20%
Energy Storage	10%



This graphic was presented as a directive for the ETP program management from CPUC ED

TechFLOW

April 2011

Lighting Makeover Planned at the World Famous San Diego Zoo



LED lights will dramatically reduce The San Diego Zoo's energy consumption

San Diego Gas & Electric will soon be lowering the energy consumption at the San Diego Zoo. Currently, the zoo operates two large gift shops which employ MR-16 track lighting to illuminate the store area and displays. MR type lighting is very effective for directional lighting, such as used to highlight objects in a display, but the halogen technology in these bulbs operates around 500°F, and there is clearly some room for efficiency gains. For this reason, there is great potential for an LED retrofit which will really make these MR-16 lit displays "pop." Working with Account Executive Janisse Martinez, SDG&E has demonstrated the benefits of LEDs to the Zoo facilities managers, and we are preparing to install LED retrofit track lighting throughout the two gift shops. Several lighting temperatures and beam angles were considered, and the Zoo marketing staff was able to choose a solution that will exhibit their merchandise in a better light, pardon the pun. SDG&E ETP will also study the impact of lower lighting power density on the HVAC equipment energy use in one of the gift shops.

Highlights

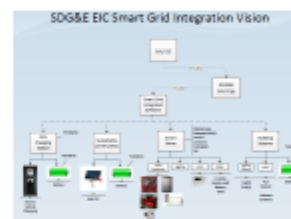
- LED lighting upgrade for directional lighting
- Better product display illumination
- [Contact Nate Taylor for more information.](#)

Smart Grid for Buildings Emanating

At the Energy Innovation Center, we are planning to demonstrate a Smart Grid Integration System which can monitor and control various subsystems around the building. This system will integrate the building management system, lighting controls from two vendors, electric vehicle charging, Solar PV, building ventilation, and home area network. The smart grid software shed load in various building loads based on a real or simulated signal from CAISO. It will adjust HVAC and lighting, release energy from the batteries, and limit EV charging during this event. Emerging Technologies is working with Cisco and GE to bring this Smart Grid Integration Vision to Life!

Highlights

- Monitors and controls various subsystems around a building
- [Contact Eric Martinez for more information.](#)



Time to Reroof? Time to Think Solar! Great rebates! Lower utility bills!



Solar roofing is a crucial factor for zero net energy

The California Solar Initiative (Go Solar California) awarded a contract to a partnership between ConSol and GE to conduct research on lowering the cost of roof-mounted solar systems with an innovative "plug and play" photovoltaic (PV) system developed by GE for the asphalt shingle reroofing market. Standard roofers will be able to quickly install this PV system without requiring any penetrations in the new shingles. Demonstrations will be conducted on six volunteer homes in SDG&E territory. In addition SDG&E ETP may fund other energy efficiency improvements in some of the homes to optimize the size the solar PV system and increase the energy efficiency of the homes.

Benefits:

- Lower cost than other roof-mounted PV systems
- Designed specifically for asphalt reroof projects
- Includes a GE in-home display
- [Rebates](#) and tax credits available

Requirements:

- First come, first-served (six homes only!)
- In need of new asphalt shingle roof
- Able to provide access to utility bills
- Ability to finance or purchase roof and PVs

For more information, please contact ConSol at csi-info@consol.ws.

SDG&E's Emerging Technologies Program identifies, evaluates, and demonstrates promising technologies to save customers money and energy while meeting California's future energy efficiency goals. The program is authorized by the California Public Utilities Commission and funded by California utility ratepayers. SDG&E is a member of the Emerging Technologies Coordinating Council. For more information, please visit sdge.com/emergingtech or email us at ETInfo@sdge.com. ©2011 San Diego Gas & Electric Company. All trademarks owned by their respective owners. All rights reserved.

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Appendix II. News Release on Demonstration Home from City of Chula Vista



NEWS RELEASE

Office of Communications

CONTACT: Anne Steinberger, Marketing & Communications Manager
Office: (619) 691-5296; Cell: (619) 755-9266

FOR IMMEDIATE RELEASE: January 12, 2012

**EXTREME MAKEOVER! CHULA VISTA SUSTAINABLE ENERGY SHOWCASE HOME
OPENS JANUARY 24**

A typical neighborhood home in Chula Vista has been transformed into extraordinary, efficient, attractive, comfortable, and cost effective. The City of Chula Vista, ConSol, and San Diego Gas and Electric (SDG&E) Emerging Technologies Program along with General Electric (GE), California Center for Sustainable Energy (CCSE), the County of San Diego, and Sweetwater Authority teamed up to complete the makeover. The home, located at 590 Fig Avenue in Chula Vista, will be opened to the public at a ribbon cutting ceremony at 1 p.m. on January 24. Guests will have the opportunity to hear from the project partners and tour the property to learn about the energy upgrades that were installed to achieve more than 50 percent in energy savings. The event kicks off a one-year public information program where the Fig Avenue home will be open for tours, training, and as a venue for case studies.

As part of the home's energy upgrades, ConSol is leading a \$1 Million California Solar Initiative (CSI) Research, Demonstration and Deployment (RD&D) grant in partnership with GE and SDG&E. Funds from this research effort were used to support the CSI RD&D project aimed at lowering the cost of solar photovoltaic (PV) installations, through energy efficiency retrofits and a state-of-the-art GE 2.4 kW PV system installation. The PV system will reduce the home's energy demand and carbon footprint and provide an opportunity for GE to demonstrate its new "plug & play" solar energy system technology, designed to be cost-effectively installed by standard roofing contractors and electricians. GE also has installed a home energy network at the Fig Avenue home to help the future homeowners track and manage their energy use. The Fig Avenue Showcase Home served as a training opportunity for roofing contractors, electricians, and solar installers who worked together to install this prototype system. This effort provided GE valuable feedback and information that will be used to incorporate solar installation into a standard re-roofing project.

276 Fourth Avenue, Chula Vista, CA 91910 | www.chulavista.gov | (619) 691-5296 | fax (619) 409-5448 | communications@chulavista.gov

BUSINESS MODEL – Plug and Play Solar PV Kit

Installation of the energy efficiency upgrades was completed by CCSE's GETUP program funded by a \$600,000 County of San Diego workforce development grant. This portion of the GETUP green jobs workforce training program consisted of 12 unemployed or underemployed participants who gained hands-on experience installing energy-efficient lighting, insulation, air sealing, water heating, and HVAC systems. Additional workforce training is occurring with Southwestern College horticulture students, who are designing and installing drought-tolerant, sustainable landscaping at the property.

During the next year, the Chula Vista Sustainable Energy Showcase Home will be highlighted through public open houses for the Energy Upgrade California Community Savings Initiative (the third Saturday of each month from 10 a.m. – noon), onsite contractor and student trainings, and video case studies. The home also will serve as a demonstration site for other Energy Upgrade California events, and the Chula Vista Home Upgrade, Carbon Downgrade Program. These programs help to make home energy upgrades more affordable for residents through special discounts, incentives, and 0% interest loans.

The City of Chula Vista, in collaboration with Community HousingWorks, purchased the distressed property in September 2011 at a substantial discount through the Chase Community Revitalization Program. After an initial showcase period, the property will be resold to a qualifying low-income family through the Chula Vista First-Time Homebuyer Program. Applications and requirements will be available March 1, 2012.

For more information on the Chula Vista Sustainable Energy Showcase Home and the City's First-Time Homebuyer Program, please visit www.chulavistaca.gov/clean.

###

Appendix III. Marketing Flyer - Open House Chula Vista Demonstration Home

Find out about available rebates at:
www.EnergyUpgradeCA.org

Open House

Welcome to the Chula Vista Sustainable Energy Showcase Home

Come in and learn about **all** the steps you can take to make your home more energy and water efficient, healthier, and more comfortable.

The Chula Vista Sustainable Energy Showcase Home project team retrofitted this house to achieve "deep" energy savings of over 50%, to demonstrate a new "plug & play" solar photovoltaic system, and to provide a local green job training opportunity.

The distressed property was purchased through the Chula Vista First-Time Homebuyer Assistance Program and will be resold to a qualifying low-income family.

The home will be highlighted through public open houses, onsite contractor trainings, and video case studies that promote affordable and effective home energy and water improvements and available rebate programs.

The home will also serve as a demonstration site for the Energy Upgrade California Community Savings Initiative and Chula Vista Home Upgrade, Carbon Downgrade program that both help to make home energy upgrades more affordable for residents through special discounts, incentives, and 0%-interest loans.

The home will be highlighted through public open houses, onsite

-  **Saves You Money**
-  **Increases Your Health and Safety**
-  **Improves Your Comfort**


energy upgrade CALIFORNIA
COMMUNITY SAVINGS INITIATIVE

Partners and Sponsors:
CITY OF CHULA VISTA, CONSOL, SDGE, Center for Sustainable Energy, GE, CHW, Carey, GE imagination at work, Community Resources, SUPERIOR ENERGY.

Energy Upgrade California is a partnership of the California Energy Commission and the California Public Utilities Commission, and is funded by California's utility customers through the Renewable Energy and Environmental Act, a 2001 California Energy Commission, State of California.

Find out about available rebates at:
www.EnergyUpgradeCA.org

15 “Plug-and-Play” Solar PV System




Overview:

Solar energy can effectively shift and reduce peak electricity use, lowering your electricity rate and bill.






Some innovative features of GE's new low-cost “Plug-and-Play” solar product:

- Designed to be easily installed by standard roofing and electrical contractors
- Does not require any special installation tools
- Uses accepted methods for the flashing of rooftop penetrations resulting in a worry-free 20-year warranty that covers both the system and the roof
- Includes a unique comprehensive energy management system with Home Energy Monitor and Demand Response Controller, allowing you complete control over your home's energy system.

This “PV Appliance” approaches a \$4.50/Watt installed cost, so a 4.8 kilowatt system could actually earn you \$107 per month!



Energy Upgrade California is a partnership of the California Energy Commission and the California Public Utilities Commission and is funded by California utility customers and the American Recovery and Reinvestment Act. © 2011 California Energy Commission, State of California

J. REFERENCES

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